RAILROAD GAZETTE

FRIDAY, MARCH 9, 1894

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Contributions

Safety in Car Lighting.

WARREN, O., March 3, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of March 2, I find the following in regard to the safety of compressed gas, as translated from *Glaser's Annalen:* "Lighting by gas has been proved and found reliable during more than 20 years, ... and yet during that long period not a single fire on destroyed cars could be traced to the gas lighting."

I was in a car a few years ago when it caught fire from the gas, and was entirely destroyed, and the vestibule on an adjoining Pullman car burned off, before the cars could be separated. Only by prompt action of the writer in organizing a "bucket line," and the prompt and willing help of other passengers, saved two Pullman cars. The rear of train happened to stop on a bridge over a creek, from which we procured water. This fire originated in the closet of the car, where by some means, not discovered at the time, the gas escaped and was ignited, and was not observed until it broke through the glass, over the closet, and when the writer attempted to put on the brakes by means of the conductor's valve, the rope attached to same, *inside* the closet was burned to such an extent that it broke apart when he pulled it. The train was running about 40 miles an hour at the time, and the panic which ensued threatened to be serious, though all escaped to the forward car, with the loss of only a few lunch baskets and wraps. Gas is good for light, and I think safer than anything except electricity, but this case shows the desirability of connecting the conductor's cord to the valve handle outside the closet.

W. C. P.

Bryan, Donkin and Kennedy's Boiler Tests.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read the report of an elaborate series of boiler tests made by Bryan, Donkin and Kennedy in England, covering nine different kinds of boilers, given in the *Railroad Gazette*, Feb. 16 and March 2. The tests were made with the design of obtaining results in each case which would be exactly comparable with the others. With this end in view the same kind of fuel was used in all tests and careful experiments were made to determine the heat lost by radiation, etc. Notwithstanding these precautions and painstaking efforts for accuracy a brief inspection of the table shows an astonishing lack of attention to some points which to a great degree annul the comparative value of the tests. The failure to provide the additional data is the more surprising, as some at least could readily have been supplied.

The most obvious omission, which is also noted in the test, is that of determining the amount of moisture in the steam. As all the tests excepting No. 10 were made with the boilers furnishing a practical constant quantity of steam per hour, there seems no good reason why an accurate calorimetric determination of the condition of the steam should not have been made.

The thickness of the fire and method of firing varied greatly in the different tests and in an apparently unaccountable way. In test No. 1, with a very soft draft, the fire was from 11 in. to 15 in. thick on the grates, while in tests Nos. 9 and 10, with draft nearly six times as strong, a thickness of from 4.8 in. to 5.9 in. only was maintained. The frequency and manner in which fresh coal is charged into the firebox have a great effect upon the fuel economy, and some note or explanation should accompany such wide variations in practice as are found in these tests. The figure 7 in column 5 is probably an error, possibly in the location of the decimal point; but aside from this the firing varied from continuous to one charge in 28½ minutes. It is possible the experimenters had good reasons for this lack of uniformity; if so, they should be given.

Unless tests of this kind are accompanied by full notes and explanations of apparent anomalies or peculiarities, their usefulness for purposes of comparison is very much lessened. These tests show a large amount of very painstaking and exceedingly good work, which naturally emphasizes the few omissions I have noted, making it all the more to be regretted that the value of the results is lessened by doubts and omissions which could readily have been cleared away or supplied. I send this communication hoping that some of those who took part in the tests will explain the reasons for the apparent omissions.

TUBES.

Automatic Block Signal Patents.

The Hall Signal Company,
NEW YORK, March 5, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:

We have neither the time nor the inclination to be drawn into a protracted controversy regarding the claims of the Union Switch and Signal Company as to the rights of the Hall Signal Company to use certain track circuit systems for the operation of its automatic block signals, but, inasmuch as the Union company has seen fit to attempt to sustain its position by dependence upon groundless claims, we beg your indulgence to the following extent:

It may be of interest to your readers to be informed that the use of the rails as a conductor of electrical currents for the operation of railroad signals is very old, and in the broad use of this plan the Union company has never had its alleged exclusive rights respected, as it never possessed any such rights. As they have seen fit to threaten suit in the matter, we think it best to defer the presentation of our proofs until the suits are actually instituted, although, up to date, we have received no notification whatever of the institution of such suits.

Our systems are the product of the inventive and mechanical skill of our own engineers and designers. They represent every new and radical improvement that has been effected in the art of automatic block signaling during the last five years, and are fully protected by patents that have been issued to us within that time. We have taken the best legal advice at every step of our growing business and have so shaped it as not to infringe upon the rights of any other persons or corporations whatever. Some two years ago the very threats of suit now repeated were made against several railroads, and the questions involved were submitted, as we are informed and believe, to the Eastern Railroad Association. We were invited to present our views and did present them, and, as a result, the said railroads, acting on the advice of said association, continued to use and further introduce our systems, and have ever since continued to do so; and none of the threatened suits have ever been heard of since. We stand ready to guarantee to all railroad companies the full and continued use of our systems, and shall see to it that they are put to no expense or annoyance in connection with these stale claims. The claims have no foundation in fact, and no justification in purpose beyond that of the drowning man in clutching at a straw. We shall be happy to make any further and more formal guarantees in the premises that the railroads may desire. Our system is beyond all comparison the best in the market. It has come to stay. It does not involve a trespass upon the rights of any other person or corporation, and we propose to give the railroads and the public the benefit of it.

The Union Switch and Signal Company's statement to the effect that the President of the Hall Signal Company advertises that, on the basis of efficiency the track circuit is found wanting, both in the theory of its construction and in the records of actual work, and that the Hall Signal Company is prepared to erect signals on this system for those who deliberately desire such, is unqualifiedly false, in so far as its present position in the field of track circuit signaling is concerned. We did thus advertise some four years ago in the original catalogue issued by this company, and so far as our radical statement of the inefficiency and unreliability of the track circuit system, as installed by the Union Switch and Signal Company, is concerned, nothing that has since transpired has led us for one moment to doubt the absolute correctness of the position we then assumed. It is true that we recognized certain weaknesses in the original systems we installed, but it is equally true that in developing those systems we have fully succeeded in producing a system of automatic electric track circuit signals that has proved itself to be absolutely reliable, thoroughly efficient and very economical in operation. We also wish to have it distinctly understood that we possess the only system of automatic signals on the American market to day that fully meets the conditions outlined above. This statement is more than a claim. It is a statement of fact that can be fully and completely substantiated at any moment. It would have been well for the Union Switch and Signal Company if, instead of blindly adhering to systems of signals whose unreliability and inefficiency are to-day notorious, it had also joined in the march of improvement. We regret that, in their communication to the *Railroad Gazette*, they have seen fit, not only to attack the construction of the Hall automatic block system, but also the judgment of the officials of the many railroad companies who have indorsed and adopted the system after extended investigation.

WM. P. HALL, President.

Patents on Derailing Switches.

RAHWAY, N. J., March 6, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Our attention has been directed to the fact that the Union Switch & Signal Co. has issued a menacing circular to railroad officers containing statements to the effect that the said company owns a patent granted to A. G. Cummings in 1883, and that it proposes to enforce said alleged patent rights. This patent was granted for the use of switches in connection with interlocking plants so arranged and interlocked as to prevent a collision should a train overrun a signal at danger, by in some cases turning it along a diverging track, and in others derailing it by the use of a short facing switch. It will scarcely be necessary to explain to those at all conversant with the matter that this patent of Cummings has been absolutely void from its issue, and should never have been granted, for the reason that switches, derailing and otherwise, were in common use, in exactly the way shown and described by Cummings, for many years previous to 1883. We may refer to such well-known previous publications as the signal exhibits at the Centennial Exhibition at Philadelphia in 1876, and the interlocking apparatus installed at East Newark Junction in 1875 and for many years in practical service at that point.

The fact is that there are many previous publications; but as the issuance of an anticipating patent is the most convincing we may refer to the following letters patent granted in Great Britain to J. S. Williams, of Riverside, N. J., viz.: No. 3,256 of 1877; No. 995 of 1878, and No. 5,005 of 1878.

It occurs to us that if this patent had really amounted to anything the Pennsylvania Steel Co., who were the first assignees, would have sued the Union Switch & Signal Co. for infringement years ago, and that the Union Switch & Signal Co., who bought the Pennsylvania Steel Co.'s interlocking patents about five years ago, could have obtained an injunction against us, preventing our carrying out even a simple junction or crossing.

We are prepared to guarantee to our friends immunity from all royalties or damages in connection with all the appliances which we supply or erect, as heretofore.

THE JOHNSON RAILROAD SIGNAL COMPANY,
Henry Johnson, General Manager.

Richmond Two-Cylinder Compound Freight Locomotive.

In the *Railroad Gazette* for Feb. 23 last appeared a news item to the effect that through the courtesy of Mr. William Garstang, of the Cleveland, Cincinnati, Chicago & St. Louis, and Mr. W. F. Renshaw, of the Illinois Central, the Richmond Locomotive & Machine Works was exhibiting its new ten-wheel compound freight locomotive to the Western railroad men at Chicago. The locomotive is a two-cylinder compound, the compounding features being similar to the locomotive built in 1893 by the same company for the Chesapeake & Ohio. This latter locomotive was illustrated in the *Railroad Gazette* April 21, 1893. The illustration given with this is from a photograph of the freight locomotive under construction and shows the general appearance of the machine.

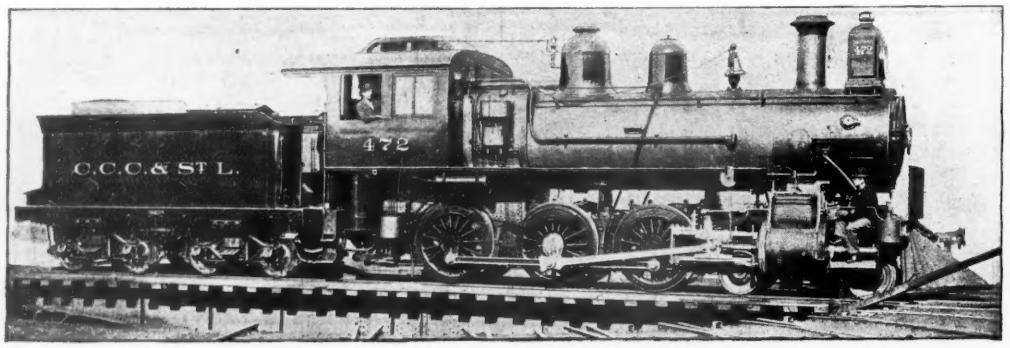
We are not permitted to illustrate the intercepting or "emergency" valve at present, but from Mr. Barnes' revision of Professor Woods' book on Compound Locomotives we quote: "In the cylinder saddle there is a small piston with a dash pot connected to the piston rod which controls an intercepting valve placed horizontally. The intercepting valve shuts off the steam, that is admitted to the high-pressure cylinder at starting, from entering the receiver. Surrounding the small piston is an annular sleeve or piston which serves as a reducing valve. The emergency valve consists of a plain, bevel seated valve attached to a piston which is connected on one side to a live steam pipe leading to a valve in the cab. This piston is returned to its seat by a spring on the piston rod. The device operates as follows:

"Steam from the main steam pipe acts upon the annular piston around the intercepting valve stem, and forces the intercepting valve to its seat, thus closing communication between high-pressure cylinder and the receiver. At the same time the sleeve or annular piston opens a small port which admits steam to the low-pressure cylinder directly from the main steam pipe, through a three-inch pipe. This sleeve then acts as a reducing valve. . . . When the intercepting valve is closed, the exhaust from the high-pressure cylinder accumulates in the receiver and pushes the intercepting valve back to an open position, and the engine works compound.

"When it is desired to work with a separate exhaust

for the high-pressure cylinder, the engineer opens a valve in the cab and admits steam back of the piston, which is connected with the emergency valve. The pressure on the piston forces the emergency valve open. This opens communication from the receiver to the atmosphere and gives a separate exhaust for the high-pressure cylinder. This system can be used automatic or non-automatic. In this respect it is one of the few compounds having a separate exhaust for the high-pressure cylinder. The advantage of this is that it renders it possible, in case of accident to one side, to run with the other side the same as with an ordinary simple engine."

Excepting the compounding features, the locomotive was built from drawings furnished by the railroad company. The principal dimensions and data are given in the following table:



Compound Freight Engine for the Cleveland, Cincinnati Chicago & St. Louis Railroad.
Built by the Richmond Locomotive & Machine Works.

Description.	
Type	10-wheeler
Name or Number	472
Name of builder	Richmond Loco. & Machine Works
Name of operating road	Cleveland, Cincinnati, Chicago & St. Louis
Gage	4 ft. 8½ in.
Simple or compound	Compound
Kind of fuel to be used	Bituminous coal
Weight on drivers	107,100 lbs
" " truck wheels	29,900 "
" total	137,000 "
General Dimensions.	
Wheel base, total, of engine	23 ft. ½ in.
" " driving	11 " 10 "
" " total (engine and tender)	48 " 8½ "
Length over all, engine	36 " 4½ "
" " " total, engine and tender	58 " 1½ "
Height, center of boiler above rails	7 " 11½ "
" of stack	14 " 5 "
Heating surface, firebox	155 sq ft.
" " tubes	1,750 " "
" " total	1,905 " "
Grate area	31½ " "
Wheels and Journals.	
Drivers, number	6
" diameter	56 in.
" material of centers	Cast iron
Truck wheels, diameter	28 in.
Journals, driving axle, size	8 in. dia. × 9½ in. long
" truck " "	5¾ in. dia. × 10 in. long
Main crank pin, size	5½ in. dia. × 6½ in. long
Cylinders.	
Cylinders, diameter	19 and 30 in.
Piston, stroke	24 in.
" rod, diameter	3½ in.
Main rod, length center to center	9 ft. 1 in.
Steam ports, length	23 in
" " width	L. P. 1⅞ in. and 1¼ in. (H. P.)
Exhaust ports, length	23 in.
" " width	H. P. 2½ in. and L. P. 3¼ in.
Bridge, width	H. P. 1¾ in. and L. P. 1⅝ in.
Valves.	
Valves, kind of	Richardson's balanced
" greatest travel	5½ in.
" outside lap	H. and L. P. ⅞ in.
" inside lap or clearance,	H. P. = − 3/16 fr. − 1/16 in. back L. P − 1/16 in.
" lead in full gear	⅛ in.
Boiler.	
Boiler, type of	Belpaire
" working steam pressure	180 lbs.
" material in barrel	Steel
" thickness of material in barrel	9/16 in.
" diameter of barrel	60 "
Seams, kind of horizontal	Double belt strap
" " circumferential	Double riveted lap
Thickness of tube sheets	½ in
" " crown sheet	3/8 "
Crown sheet stayed with	Vertical stay bolts
Dome, diameter	31 in.
Tubes.	
Tubes, number	241
" outside diameter	2 in.
" length over sheets	13 ft. 10⅛ in.
Firebox.	
Firebox, length	8 ft. 11⅛ in.
" width	3 " 5⅞ "
" depth front	5 " 7⅝ "
" " back	5 " 1⅜ "
" material	Steel.
" thickness of sheets	3/8 in.
" brick arch?	Yes.
" water space, width; front, 4 in.; sides, 3½ in.; back, 4 in.	
Grate, kind of	Rocking finger grates
Smokebox.	
Smokebox, diameter	63¾ in
" length	72 "
Other Parts.	
Exhaust nozzle, single or double	Single.
" " variable or permanent	Permanent.
" " diameter	5 in.
" " distance of tip below center of boiler	4 "
Netting, wire or plate	Perforated plate.
" size of mesh or perforation	.1 ft. × 3/8 in.
Stack, straight or taper	Straight
" least diameter	18 in.
" greatest diameter	18 "
" height above smokebox	3 ft. 9½ "

The locomotive is at present in Chicago. It has been tried on the Illinois Central, and will be tried on some of the other roads centering at Chicago while it is in the West.

From the performance sheets of one of the roads on which the locomotive has run we have obtained the following comparison with 16 simple engines of the same (10-wheel) type, with cylinders 19 × 24 in. The boiler pressure in each was the same, 180 lbs. per sq. in.

Description of Locomotives.		Miles to 1 ton of coal.	Pounds coal per engine-mile.	Average cars hauled.	Average cars hauled 1 mile per ton coal.	Average pounds coal per car-mile.
Simple.	Maxim'm of 16 ..	19.38	140.13	24.6	434.1	6.38
	Minimum of 16 ...	11.30	113.23	20.5	314.0	4.79
	Average of 16....	16.21	118 27	22.4	379.0	5 29
Compound ...		21.00	83.33	23.7	568.8	3.52

It will be noted from the above that the compound not only did better than the average of the 16 simple engines, but also did better in each instance than the best simple. There is only one apparent advantage shown the compound; its loading in number of cars was greater than the average of the 16 simple engines, but was less than the average loading of several of the simple engines.

This engine was turned over by the builders, on March 3, to the Chicago, Burlington & Quincy for testing. The tests will be very complete and will be made in freight service between Galesburg and Ottumwa. After this test the C., B. & Q. will test its own two-cylinder compound in the same service over the same division. It is not expected that the results obtained from the different tests will be comparable, at least, so far as boiler efficiency is concerned, because the heating surfaces of the Richmond locomotive must be very free from scale, as it has been in service only a few months, while the heating surfaces of the C., B. & Q. engine must be well coated with scale; it has not been in for repairs for a year and has been in service three or four years. The present test of the C., B. & Q. compound will be interesting, however, to compare with the test of the same locomotive made when it was first put into service, to show what effect several years' service has on the economy due to compound cylinders.

Performance of Locomotive "Columbia" on the Chicago, Milwaukee & St. Paul.

Through the kindness of the builders, and with the sanction of Mr. J. N. Barr, Superintendent of Motive Power, we present the following report of the trials, on the Chicago, Milwaukee & St. Paul, of the Baldwin locomotive "Columbia," which was exhibited at the World's Fair.

The distance between Chicago and Milwaukee is 85 miles. The steepest grade is 35 ft. per mile, between the fourth, fifth and seventh mile posts, leaving Milwaukee. The remainder of the line has easier grades, ranging from a level to 35 ft. per mile, shorter grades of 26 ft. per mile frequently occurring. At times during the winter high winds prevail with extreme cold. The fastest schedule is 2 hours and 15 minutes, including an arbitrary of 28 minutes between Forest Glen and Chicago, 10.2 miles, and another of 8 minutes between Milwaukee and Minerva, 1.8 miles. There is also a stop of 2 to 5 minutes at Western Union Junction, and between this point and Forest Glen—a distance of 52 miles—three "slow-ups," two for railroad crossings and one at Wadsworth to scoop water. These detentions leave a running time of about 95 minutes between Forest Glen and Minerva, 73 miles, in which any reduction of time must be made. The series of runs was made for the purpose of ascertaining how much this schedule could be safely reduced, the maximum reduction, however, being fixed by the company at 15 minutes.

The "Columbia" was illustrated and fully described in the *Railroad Gazette*, May 26, 1893; but for convenient reference a few of the more important dimensions are given below:

Cylinders	High pressure, 13 × 26 in. Low pressure, 22 × 26 in.
Driving wheels, diam	84¼ in.
Weight in working order, total	126,640 lbs.
Weight in working order, on drivers	83,140 lbs.
Boiler, diam	56 in.
Boiler-pressure	200 lbs.
Fire-box	84⅜ × 42⅜ in.
Flues	198 in number, 2 in. diam., 13 ft. 1¼ in. long
Total heating surface	1,478 sq. ft.
Grate surface	24.77 sq. ft.
Tank capacity	3,600 gallons

Following are the more important runs made:

Jan. 8.—Chicago to Milwaukee, 85 miles, with seven cars, in 130 minutes, including five minutes detention at Western Union Junction.

Jan. 9.—Same trip, with nine cars, ten minutes late, arrived Western Union Junction in good condition, making up a few minutes; stop on account of hot main pin, which was adjusted and reached Chicago less than three minutes late. Time of run, two hours and seven minutes.

Jan. 10.—Hauled eight cars, Milwaukee to Chicago, making extra stop at Wadsworth for water, and came in on time; time, 135 minutes.

Jan. 12.—A run of 25 miles (speed slackened three times) was made with eight vestibuled cars in 39 minutes.

Jan. 15.—Fifty-two miles in 58 minutes, with ten vestibuled cars. Average speed, 52.3 miles an hour.

Jan. 16.—Milwaukee to Chicago in two hours and twelve minutes, with nine cars. Coal consumed 4,000 lbs., equal 47.3 lbs. per train-mile or 5.23 lbs. per car per mile.

Jan. 17.—Milwaukee to Chicago, started six minutes late, with nine cars. Arrived on time, in two hours and nine minutes. Weather very hazy—special order not to run fast.

Jan. 18.—Left Milwaukee six minutes late with nine cars. Arrived Chicago on time, in two hours and nine minutes. Coal consumed, 6,000 lbs. for entire trip, equal 70 58 lbs. per train-mile, or 7 84 lbs. per car per mile. Head wind.

The Mason Air Signaling Apparatus.

Many improvements have been made from time to time in the signaling apparatus of the Mason Air Brake and Signal Company, and now the company thinks it has a perfect device. The illustrations given with this show the automatic reducing valve, the regulator, the signal valve and car valve in the perfected design of each.

The automatic reducing, non-return valve is shown in fig. 1*a*; when in position it is bolted direct to the regulator shown in fig. 2*a*. Fig. 1 shows clearly where the connection to the main air signal reservoir and the one to the regulator are made. The position of the valve as shown allows air to past through it from the main reservoir; the course of the air being through the strainer 6, fig. 1*a*, to chamber *d*, past the valve 8 through *e* to passages *f*, *g*, raising the non-return valve 4 to the passage *i* and to the regulator. The spring 14, fig. 1*b*, is adjusted to allow the desired pressure, 60 lbs., to be carried in the signal pipe; any excess of this pressure compresses the spring, seats the valve 8 and prevents further flow of air from the main reservoir. The adjustment for the regulator spring is clearly shown at the lower end of the cut.

The regulator is shown in figs. 2*a* and 2*b*; its position is in the locomotive cab, located conveniently for operation by the engineer. The reducing valve is attached by two bolts, 24, and the regulator is supported in place by suitable bracket attached at 23. The regulator handle has three positions; the supply, for charging the signal pipe; the position for short train; and position for long train; the special office of each of the last two positions is clearly defined by the names. The pressure in the signal pipe is maintained against leakage by the passage of air from chamber *m*, through opening *n* to chamber *o*, and so to the signal pipe. The function performed by the coiled spring is to close the leakage port *n*, should the main reservoir pressure be too low; by this arrangement signals may be given, though there be no pressure, above the atmospheric, in the main reservoir. In referring above to long and short trains, it is understood by a long train that there are more than five cars in the train, a short train is one of five, or less. When the regulator handle is in the position for short train the 10 × 19 reservoir, connected as shown, forms a part of the signal pipe; for long trains this reservoir is cut out. This reservoir is necessary, because the attachments are designed to work perfectly on a twenty-car train, and although they will operate entirely satisfactorily on a train with a less number of cars, yet when the number is less than six, it is found desirable to increase the volume of air in the signal pipe by cutting in the 10 × 19 reservoir.

The important recent improvement in the signal valve shown in fig. 3*a* and 3*b* is the introduction of the valve 22 which prevents more than one sound of the whistle being given for one reduction in the signal pipe. The action of the valve is as follows: Normally there is equal pressure on both sides of piston 3; a reduction of the pressure in the signal pipe allows the then greater pressure in signal valve reservoir and chamber *c* of the valve to raise the piston and its stem 3; this movement uncovers the passage *e*, and allows air to flow from the reservoir, through *n* and *e* to passage *f*, passage from f^1 to *p*, which is normally open, g^1, *h*, *j*, and to the whistle. A part of the air that enters the space *h*, above the piston, passes through *k*, to the non-return valve 22, raising this valve and giving communication to the chamber *m*, through the passage *l*. The pressure thus obtained on the underside of the diaphram 15 raises the piston 17 and holds the end of its stem against its seat at f^1, and cuts off further passage of air from the reservoir to the whistle, till another reduction is made in the signal pipe. As soon as the non-return valve 22 is raised from its seat, exhaust to the atmosphere begins through the small port k^2. The exhaust continues as long as the

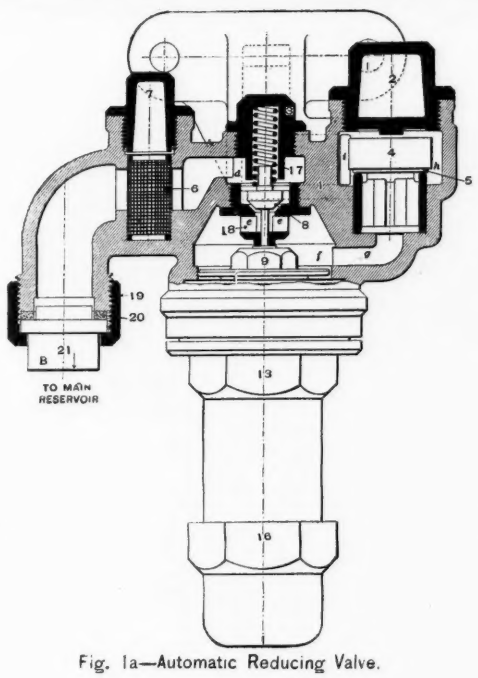


Fig. 1a—Automatic Reducing Valve.

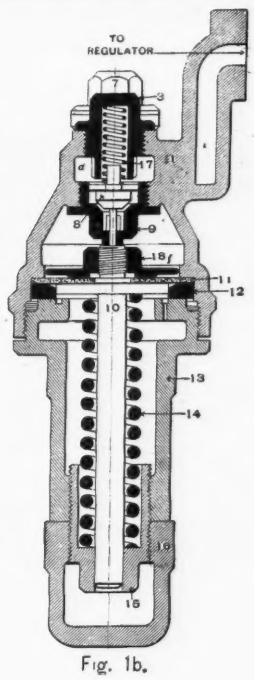


Fig. 1b.

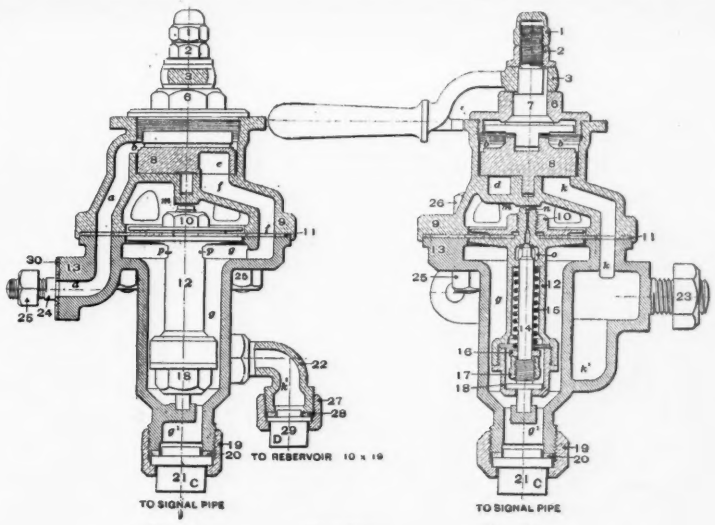


Fig. 2a. Regulator. Fig. 2b.

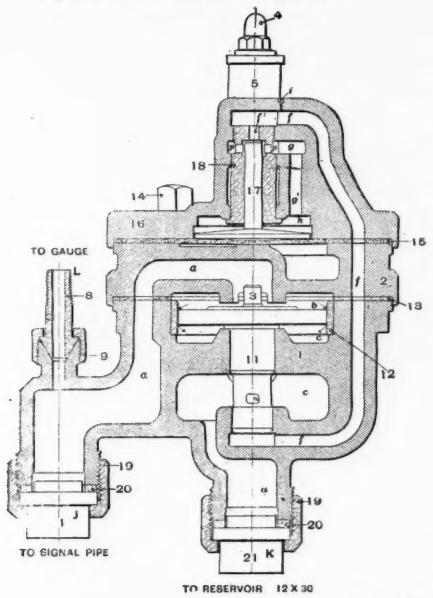


Fig. 3a. Signal Valve.

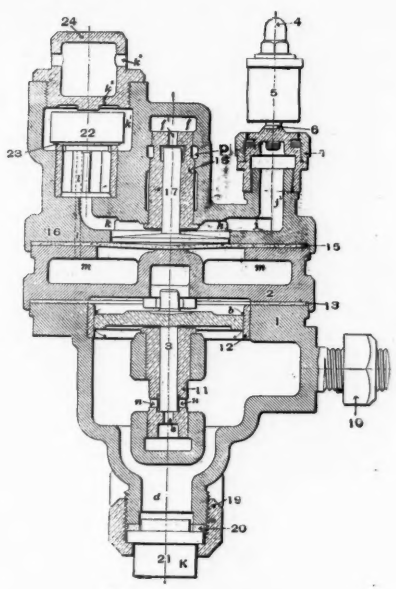


Fig. 3b.

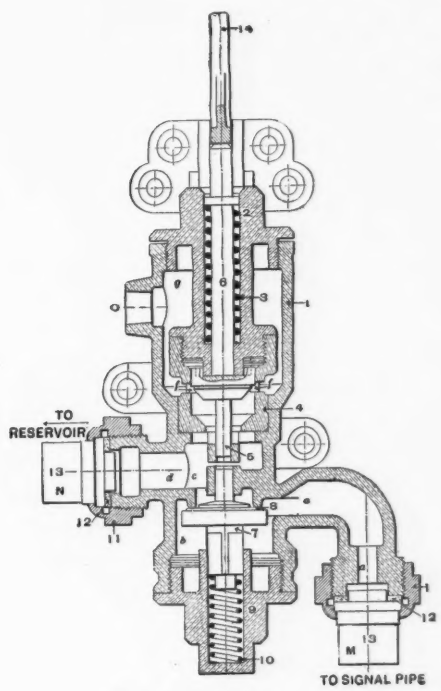


Fig. 4—Car Valve.

MASON AIR SIGNALING APPARATUS.

pressure in passage *k* is sufficient to keep valve 22 from its seat and until the pressure below the diaphram becomes that of the atmosphere. The time required for this is about one second.

Fig. 4 shows the car valve; this is located in each car. By means of a cord connected to the valve and extending the length of the car a signal may be given from any place in the car. The valve is connected with the signal pipe and with a small reservoir as clearly indicated; another connection is made at *o* with a small pipe to convey the air, which is exhausted when a signal is given to the outside of the car so that the noise of the escaping air will not be heard inside. When the lever 14 is moved to either side of the center line, perpendicular to the plane of the paper, the cam motion depresses the stem 6, and this coming in contact with the valve 5 seats it; by the same movement the stem 5 comes in contact with the stem of valve 7, unseats that valve and allows air to flow from the signal pipe to the small reservoir, and fills it through the passages *a*, *c* and *d*. The reduction of pressure in the signal pipe caused by the expansion of the air into the small reservoir is sufficient to transmit the signal to the whistle in the cab. When the strain is removed from the signal cord the spring 10 reseats the valve 8 and the pressure in the signal pipe is maintained; spring 3, together with the pressure in the small reservoir, raises the spindle 6 and valve 5 and allows the pressure in the reservoir to equalize with the atmosphere through the passages *d*, *c*, *f* and *o*.

It will be observed that with this arrangement only a certain amount of air can be drawn from the signal pipe for each sounding of the whistle, no matter how long the pull on the cord continues.

Iowa Railroad Commissioners' Report.

The sixteenth annual report of the Railroad Commissioners of Iowa has been issued by Commissioners John W. Luke, Peter A. Dey and George W. Perkins. This document seems to have been prepared in a thoroughly business-like manner and the Secretary of the Board evidently performs his duties in the very best manner consistent with the limitations which surround him. One of these limitations is the impossibility of tabulating information concerning the railroads in the way demanded by the laws of the state. The cost of road and equipment, per mile of line in Iowa, and other statistics separated on state lines, is demanded by the law, and the Commissioners have been trying for several years to get the railroad officers to make an attempt to furnish the desired information, but it looks as though the railroads had finally made it plain to the state officers that the law demands utter impossibilities.

The report gives the usual figures of stock, bonds, earnings, etc., investigations made by the Board, a list of cases decided by the courts, during the year, a list of pending litigation, a digest of the decisions of the Inter state Commerce Commission for the past year and an index to the decisions of the Iowa Commissioners since 1878 or from the organization of the Board.

The length of railroad in Iowa is 8,506 miles. By order of the Legislature, the Commissioners give a detailed report of all the railroad land grants in the state. The report shows that nine railroads have received 3,724,802 acres of land, from which eight of them have realized $16,276,697. One road has failed to report the amount realized. Seventeen passengers, 81 employees and 79 other persons were killed and 78 passengers, 682 employees and 64 other persons were injured during the the year. The taxes paid by the railroads in Iowa during the year amounted to $1,343,306, which is $63,400 more than the amount in 1892. The subject of highway crossings is treated at length and apparently in a very judicious manner. The Commissioners warn the citizens of the state to heed the lessons of experience in the older states, and show that legislative action should now be taken to prevent the further increase of grade crossings.

The matter of joint rates, the Burlington, Cedar Rapids & Northern having appealed to the courts against an order of the Commissioners establishing through freight rates over that of another road, is discussed at some length, and it is stated that the decision of the court in the case does not really decide the important points at issue.

In discussing the general subject of regulation of railroads by the state, the Commissioners ask those railroads which complain that rates fixed by the Board are not remunerative, why they do not give the Board information (which has been often asked for) which is necessary to enable them to equitably settle the question of the reasonableness of the rates.

As before intimated the statistics are in many instances comparatively worthless owing to the attempts to separate those pertaining to Iowa from those pertaining to Iowa roads outside of the state, but some of the figures are of interest, in spite of this. The number of highway crossings at grade is 8,051 of which 120 have gates or flagmen. There are 135 crossings above the track and 184 beneath. The railroads built 446 miles of fence in Iowa during the year. Only 153 miles of railroad in Iowa is double track and all of this but 10 miles is on two roads, the Northwestern and the Burlington. The roads reporting had about 140,000 freight cars, of which 36,000 had air-brakes and 47,000 automatic couplers.

Virginia Railioad Commissioner's Report.

Railroad Commissioner J. C. Hill, of Virginia, has issued the seventeenth annual report of his office. The book is a handsome bound volume of 565 pages, but the report proper occupies only two pages, the other 563 being devoted to 75 pages of correspondence, 15 pages of statistics and the reports of the various railroad companies. It is stated that there has been no new construction during the year (ending June 30, 1893), the total length of railroad in the state being 4,571 miles. Nine passengers, 69 employees and 80 other persons were killed, and 49 passengers, 1,032 employees and 151 other persons were injured. The total amount of taxes paid by the railroads in the State of Virginia for the year covered by the report was $508,703. Under the long and short haul law passed by the last legislature the Commissioner has, in one instance, exempted a road from the operation of the act. The Mason bill, in which this long and short haul law was embraced, was designed, among other things, to facilitate the prompt redress of grievances against common carriers, and the Commissioner says that it has, to a great extent, removed the friction which had before existed.

Mr. Von Borries on American Railroads.

Mr. A. von Borries, who treated so intelligently various phases of American railroading in the book which Mr. Büte and he published in Germany in 1892, and who was one of the judges at the Chicago World's Fair, read a paper on his observations on the railroad exhibits of the Fair at a meeting of the Society of German Engineers last October. He notes, what must have struck most people who have a considerable experience of foreign modes of living, that many visiting the country for the first time carry away impressions based on the strangeness of certain methods rather than on the efficiency of the practice as a whole, these impressions being sometimes very favorable and sometimes very unfavorable, according to their individual experience. Nothing is truer, as he says, than that many foreign travelers fail to find the traveling conveniences which they expect, because they have insufficient knowledge of our methods and customs in traveling; and this, be it remarked, is just as true of Americans traveling in Europe as of Europeans traveling in America. Von Borries cautions his countrymen against judging of our railroad methods from outward impressions only, and insists that they should be judged by their results. The strong point of American engineering is in progressive development of existing apparatus and methods rather than in the introduction of innovations based on new principles. The exhibitions at the Fair confirmed this phenomenon. The cause he finds in the rapid development of the country, attended with a great demand for machinery of all kinds, and giving occasion for the greatest division of employments, making effective the practical talents of the people, and rapidly bringing certain branches of manufacture, as, for instance, that of machine tools, to the highest perfection.

On the other hand, there was no time for the spread of scientific technical education; and this is still comparatively limited. Consequently, branches of industry requiring scientific knowledge are backward, and the introduction of innovations based on new principles has been delayed. And when attempts have been made to introduce such innovations, not infrequently errors are made in carrying them out, which plainly show defective scientific judgment.

Railroads afford a field for great and varied practical experience and judgment for their continued development, and in America they display a specially advanced condition. The very indisposition to experiment with wholly novel appliances has preserved a uniformity on American railroads found nowhere else except in England, and this greatly favors the general utilization of the rolling stock and the reduction of working expenses. In Germany the high degree of scientific technical education so general has caused the railroads to adopt many appliances differing very greatly from each other, which, though very interesting and excellently adapted for certain special purposes, have an unfavorable influence on their general utilization and on expenses. Yet the difference in the development of railroad appliances in the two countries is partly due to differences in the requirements. The through traffic is of transcendent importance in America, the local in Germany.

After noticing separately some of the principal American locomotives exhibited, von Borries says that these as a class are distinguished by comparatively great capacity and cheapness of construction, while in many details, as in consumption of steam and coal, they are inferior to the European engines, which are usually lighter in proportion to heating surface. The New York Central's "No. 999," compared with the French Northern compound engine, is simple and cheap, and develops the average 800 horse power required by means of the great steam-generating capacity of its large boiler, without full utilization of the steam, and therefore with great consumption of coal. The French engine is neither simple nor cheap, but by its complete utilization of steam it develops the same power with the greatest economy in every direction, and with 15 per cent. less weight in the engine.

On the whole, European and American locomotive engineers had much to learn from each other's practice, one about as much as the other, so that the exhibition was of important advantage for the development of locomotive construction.

Comparing the German with the American railroads, von Borries concludes that in purely technical matters, such as the construction of the road and rolling stock, the German roads rank about equally with the good American roads. Advantages and disadvantages will about balance each other, and are based partly on differences in the requirements. In the utilization of the railroads, however, the Americans are doubtless ahead, as under similar circumstances the expense per ton-mile and per passenger-mile is very little greater in America than in Germany, in spite of the fact that wages and salaries, which form the great bulk of all working expenses, are on the average three times as high in America. This difference is too great to be explained away by differences in traffic, statistics, etc. It is rather chiefly due to the more practical division of business and duties in the American railroad management; and von Borries is not willing to admit, as some German critics claim, that equal service cannot be obtained from the German as from the American railroad employees. We will add that the Germans, after a few months' service on our railroads, would probably do just what our railroad men do, who are not by any means all Americans.

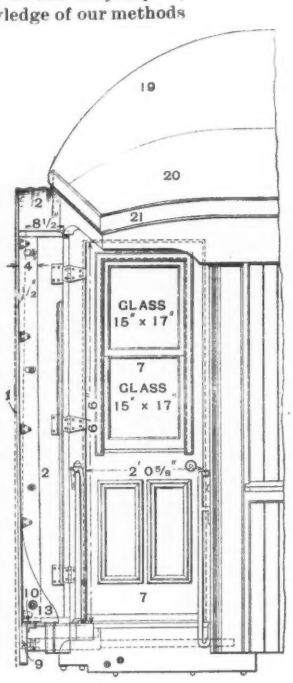


Fig. 14.

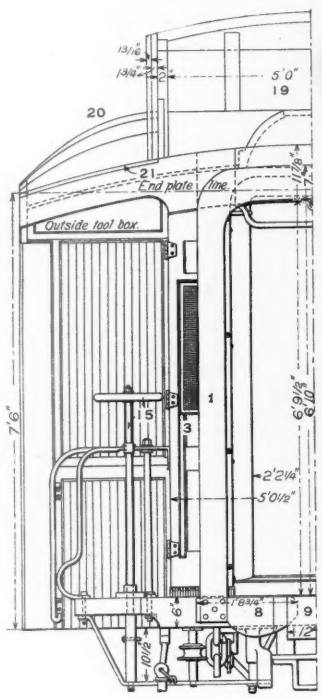


Fig. 15.

THE BARR IMPROVED WING VESTIBULE.

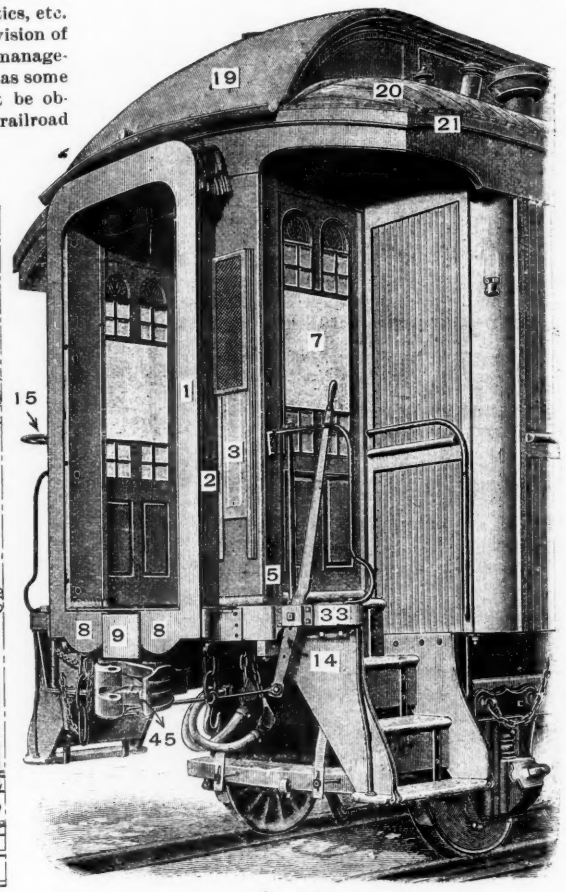


Fig. 16.

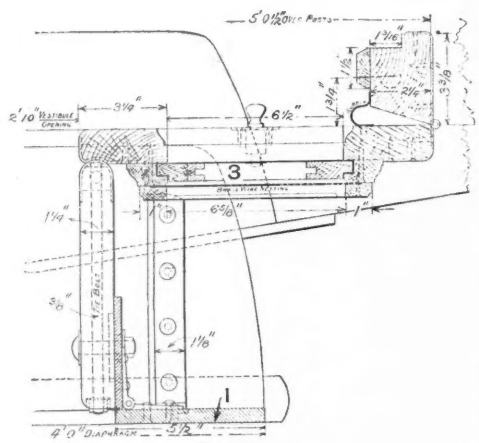


Fig. 17.

Plan of Wings, Barr Vestibule.

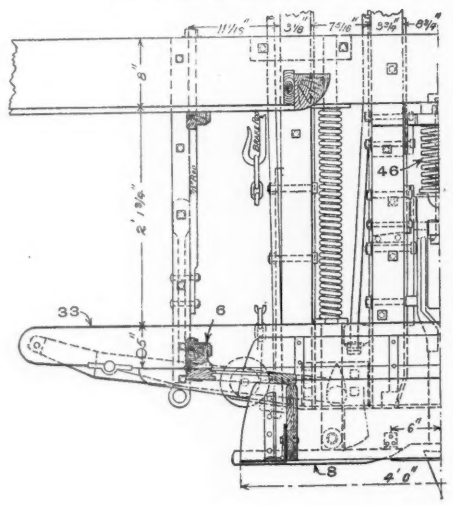


Fig. 18.

Plan of Platform, Barr Vestibule.

Vestibules, Platform Canopies and Hoods.

(*Continued from page* 154.)

One type of vestibule, which is quite common in the Northwest, West and South is the Barr vestibule, patented in February, 1890, and manufactured by the Drexel Railway Supply Company, of Chicago. The chief difference between this and the Pullman vestibule or those already described, is that it is made up of folding doors and does not require a rubber or canvas diaphragm between the face plate and the car frame. In this respect it is an evasion of the Sessions and Pullman patents in that it requires no diaphragm, no double side doors and no spring pressure, it being kept in contact at the top by its own gravity. This vestibule is illustrated in its improved state by figs. 14, 15 and 16. It consists of a face place (1), two outer wings (2) in the place of the flexible diaphragm of the Pullman vestibule. The outer wings (2) are hinged to the face plate (1), and also to the inner wings (3), which are in turn hinged to the end or corner post (5). This system of folding doors is shown in more detail in the plans figs. 17 and 18. This device dispenses with the expensive rubber diaphrams, permits the use of a single door (7) at the side instead of the double folding doors, and gives two windows with wire screens for ventilation in the inner wings (3), shown in figs. 15 and 16. The construction of the platform and the buffing device is shown in the plan fig. 18. The top of the face plate is kept forced out to meet its companion by its own gravity bearing as it does upon the edge of a footing or angle plate (13), fig. 14, which is to one side of the gravity line of the face plate; the bottom is fastened to the platform buffer. This type of a vestibule contains many unique and novel features and evades the Session's patent, having no resistance to lateral motion under spring pressure. The tilting of the face plate forward and backward is provided for by slotting the holes through which it is bolted to the outer wing (2), shown in fig. 14. The hinged wings permit lateral and longitudinal motion, yet exclude the dust and smoke. The resistance that this form offers to collision cannot be determined from the drawings because the framing above is not shown. It accompanies a continuous platform, and may be applied to any car. Its construction is simple and it is in use on eight or nine different railroads of the United States and Canada. It was first applied to a car in July, 1892.

Mr. Barr designed and patented another type of vestibule in June, 1890, shown in fig. 19, which is more like the Pullman vestibule described, in external appearance. It consists of a face plate (1), a flexible diaphragm (2) inclosing the space between the face plate and end post (5). The distinct feature is the toggle joint and bar (30) designed to keep the face plate forced out, and in contact with the one opposite to it. It has a threshold plate and double side doors, similar to the Pullman. The external appearance is very similar to that of the Pullman and Wagner vestibules. Its construction

is very simple, and the principle of the McKeen vestibule illustrated in the *Railroad Gazette*, 1893, p. 521, is strikingly similar. The first car was equipped with this vestibule in October, 1889.

The first vestibules on the Wagner Palace Car Company's car were of the Pullman type. The first public exhibition of the Pullman vestibule on a train was on April 20, 1887, when a train of five cars was run over the Pennsylvania Railroad between Chicago and New York. It consisted of three sleepers, a dining car and a combination library and baggage car. In the following December, the New York Central & Hudson River road ran a special vestibule train of Wagner cars from New York to Albany, to exhibit them to 160 invited guests. These cars were built to be run between New York and Chicago, as a limited train and consisted of six cars, one buffet, one dining, two sleepers and two parlor cars. These cars were a part of a lot of 55 vestibuled cars, ordered built for use on the Vanderbilt roads. The arrangements were complete in every detail and the train contained bar ber shop, bath room, reading and smoking room and a library. The vestibules were of the Pullman type and their use provoked the Chicago suit for an injunction, which was obtained by the Pullman company, in February, 1888; but it did not prevent the railroad companies from running vestibule cars in their trains; for their continued use incited the second suit at Boston, which gave to the Pullman company for a time the absolute and undisputed control of the vestibule features, one and all.

In 1890 Mr. T. A. Bissell, of the Wagner company, received two patents for a vestibule which was evidently designed to evade the Pullman patents as upheld by the Chicago court. Instead of the Pullman face plate a heavy molded casing was used. This type is shown in fig. 22. The vestibuling was effected by means of automatic spring curtains made of varnished duck outside and of black corduroy inside, stiffened by perpendicular steel rods and transverse strips of stout rubber, the latter serving as springs to keep them in compact folds when uncoupled.

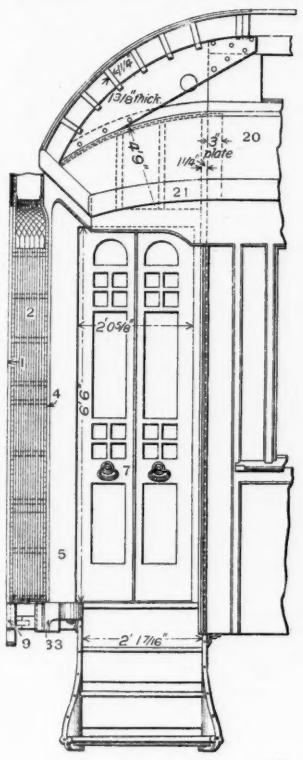


Fig. 19.
The Barr Toggle-Joint Vestibule.

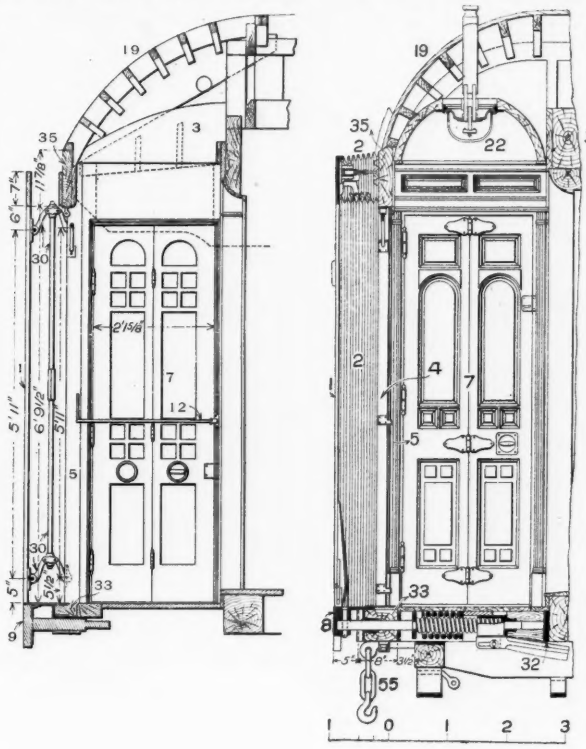


Fig. 20.

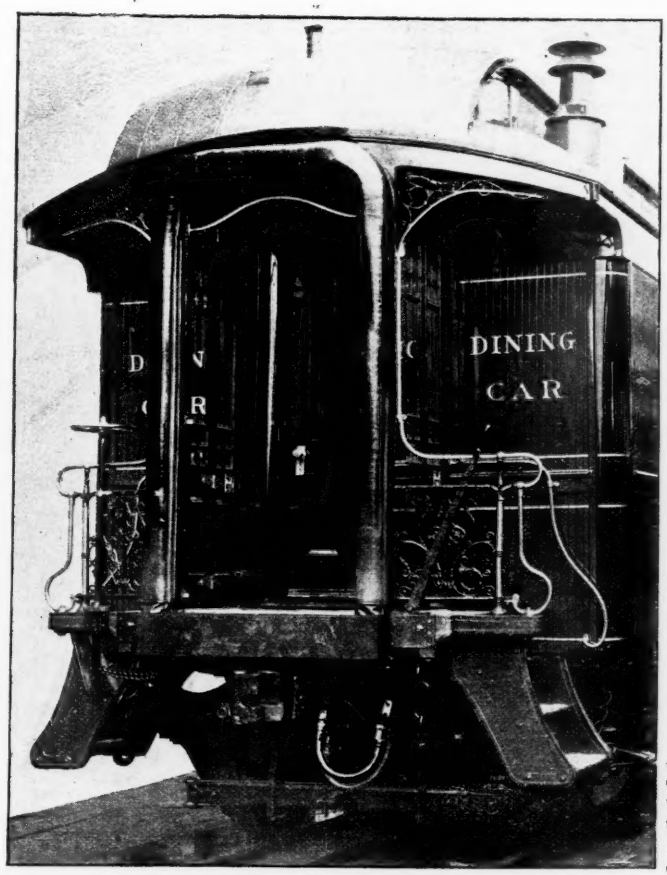


Fig. 22.

In March, 1892, Mr. Bissell received letters patent for another vestibule which covered the chief features of the Gould pendulum vestibule, now in use by the Wagner Palace Car Company.

Most of these features of Mr. Bissell's inventions were combined with others and improvements made, which resulted in the perfection of a vestibule known as the Gould pendulum vestibule, illustrated in figs. 20 and 21.

It consists of a face plate (1) with a diaphragm (2) and a back face plate (4). The face plate is made up of several pieces shown in fig. 21 and consists of an outer plate (1), hinged, as shown in 35 and 40, so as to permit lateral motion or vertical motion, and is kept forced out by the back gravity bar (28*a*) by which it is supported. The face plate is hinged and supported also by the front face plate gravity bar (41) and is prevented from frictional resistance against its opposite plate by a clip or lug (38) riveted to one face plate and covering or engaging the opposing face plate and called a face plate guide. The Gould company thus evade the Pullman patents by using a face plate which does not offer frictional resistance between the face plates, but opposes lateral motion by a system of levers, and a retaining chain (26), which latter limits the lateral swing of the face plate, as well as its longitudinal motion. These are so arranged that the weight of the face plate is utilized to keep it in position. The link motion gives all the lateral motion necessary to go around curves and to permit lateral oscillation.

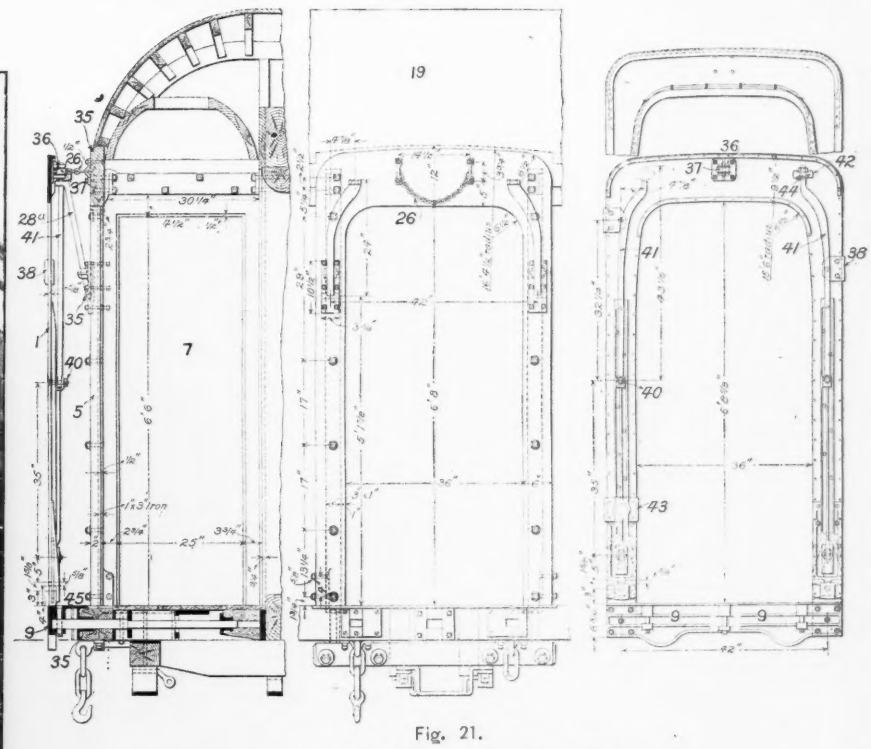


Fig. 21.
THE GOULD PENDULUM VESTIBULE.

Spring pressure is not employed at the top of the face plate, but it is kept crowded out by its own gravity supported upon the gravity bar (28 *a*) hinged at 35, a point several inches outside the gravity line of the face plate. The buffer and platform are continuous, and have the usual spring pressures devised for the purpose. A push-bar connects the buffer spring to the drawbar, so that when the coupler is drawn out the face plate is made to follow, and the springs of both the buffer stem and drawbar assist one another. The top of the face plate is held from falling out too far by the chain (26) which passes through the sheave (37). The parts of this framework are shown in considerable detail in fig. 21. This vestibule as illustrated was first applied to cars in 1892, and is in exclusive use on the Vanderbilt system, as well as on other roads.

Figs. 23 and 24 show the generable exterior appearance of this vestibule, and they will be found on page 174.

(To be continued.)

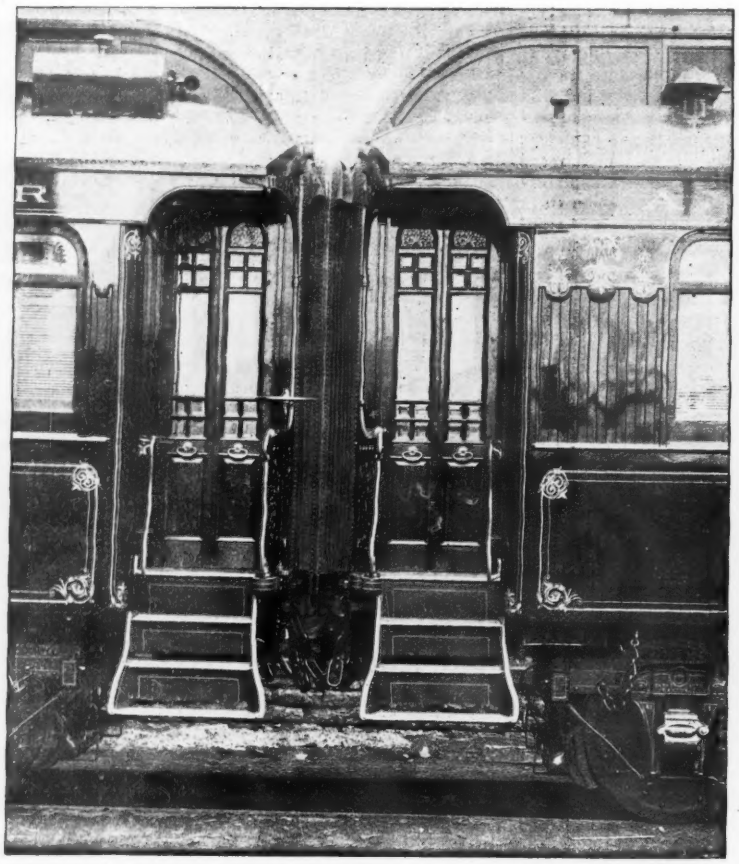


Fig. 23.

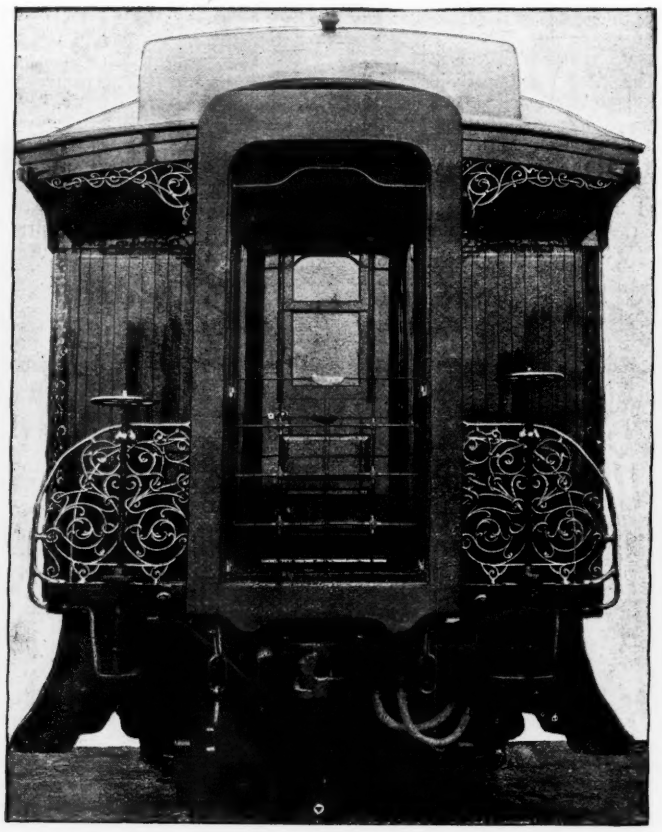


Fig. 24.

GOULD TYPE OF VESTIBULE.

[For description see preceding page.]

Steam Distribution for High Speed Locomotives.*

The weight and hauling capacity of locomotives have been increased in the past few years to such proportions that it is doubtful whether their size and number of parts can be still further increased with economy. A further increase in weight of locomotives, and in the length of trains, means increased expenditures on tracks, bridges, yards, sidings, roundhouses, turntables, and in numerous other directions, and the increased difficulties attending a farther increase in the length of our present trains. An increase in speed will lessen the cost for motive power by reducing the number of engines necessary to handle the traffic. There is a growing conviction in Europe that the economical length of train has been reached, and there is, therefore, a movement toward increasing the speed. In this country the number of limited trains shows that there is a market for high speeds. The paper proper is confined to the consideration of single expansion locomotives, chiefly because by far the largest proportion of our high-speed locomotives are simple. The indicated water per indicated horse power per hour is found by subtracting the steam found during compression from that found during expansion, which is easily computed from volume, pressure and steam tables, and multiplying the remainder by two and the number of revolutions per hour, and dividing the product by the horse power indicated. This is for one cylinder. This does not account for all the steam passing through the cylinder, as about 25 per cent. is in the shape of steam which has been condensed and is not shown by the indicator card, but the indicated water may be safely used within reasonable limits as measuring the efficiency of a locomotive when average cards are compared taken under like conditions.

Boilers.—High speeds demand a greater steaming capacity than low speeds; more trouble is experienced in making high-speed engines steam properly, and, therefore, more heating surface and larger boilers are required. Assuming that it requires no more power to keep a train moving 60 miles an hour than 30, the engine moving 60 miles per hour uses just twice as much steam in a given time as it would if going at 30 miles. It requires more power, hence more steam, to maintain the higher speed; it is plain, therefore, that the high-speed engine will use more than twice the amount of steam necessary for the slower engine.

Balanced Valves.—Tests made by Mr. Philip Wallis in 1886 on the C., B & Q. showed that 6 H. P. is required to work the unbalanced valves at 40 miles per hour, while for the balanced valves 2.2 H. P. only would be necessary.

Effect of Speed on Average Cylinder Pressure.—The resistance of a train and load increase, and the power of the locomotive decreases with increasing speed, till the resistance and power are equal, when the speed becomes uniform. The average pressure in the cylinders decreases as the speed increases. Numerous cards from the same engine and the same end of the cylinder, taken with but a short interval of time between, and under the same conditions except that the speed varied, show that the average pressure decreases in proportion as the speed increases, at least at speeds above 40 miles an hour, the main difference being in the higher steam line at the lower speeds, and consequent higher expansion line. The difference between back pressure lines was not great, which may safely be attributed to the large exhaust ports, passages and exhaust tip.

Boiler Pressure.—It is quite certain that train resistance does not increase as the square of the velocity, as is commonly supposed. It is more likely that it increases as the speed above 20 miles an hour. To increase the capacity for speed of any locomotive, its power must be increased. One way of accomplishing this is to increase the boiler pressure. That this is generally realized is shown by the increase in boiler pressure in the last 10 years. For 23 single expansion locomotives, including those of the World's Fair, the steam pressures are: Three at 160 lbs.; four at 165 lbs.; two at 170 lbs.; thirteen at 180 lbs.; one at 190 lbs. The average of the steam pressures carried by a large number of locomotives is 135 lbs. in 1882, and 174.5 lbs. in 1893, an increase of 39.5 lbs., almost 30 per cent.

Driving Wheels.—The following table shows the effect of size of drivers on the economy of locomotives in heavy express service. The locomotives, except in diameter of drivers, were as nearly alike as it is possible to make them.

Engine.	Diam. drivers over all.	Av. lbs. water per dyn. h. p. per hour.	Av. steam pressure.
145	68 in.	32 90	159.9
150	62 in.	35.15	157.3

During a trip engine 150 made 8.8 per cent. more revolutions than engine 145, and, as shown by the above table, used 7 per cent. more steam. Or the steam economy of engine 145 was about proportional to her economy in revolutions, or, the steam consumption was inversely proportional to the diameter of her drivers. Engine 145 was able to do the work required at cut offs from 4 in. to 6 in., probably the most economical range for locomotives. Engine 150 could furnish the same power at somewhat shorter cut-offs, but the necessarily higher piston speed produced uneconomical wire drawing and compression. The economy will increase with increasing diameter of drivers, provided the work at average speed does not necessitate a cut-off longer than one-fourth stroke. Cards taken from the same engines at the same speed in miles an hour and other conditions of each, show the effect that large drivers have on mean effective pressure. The piston speed of a locomotive with 62-in. drivers, at 55 miles per hour, is the same as that of one with 68 in. drivers at 61 miles per hour, and the cards show the average cylinder pressure to be the same. Large drivers will also lessen engine, track and bridge repairs. The use of higher steam pressure will allow the use of larger drivers.

Allan Valves.—The object of the Allan port is to provide a larger area through which steam may enter the cylinder, securing either a higher average cylinder pressure, hence more power, at a given cut off, or permitting the use of a shorter cut-off and greater expansion in doing the same work as a plain valve. Its advocates overlook the fact that the steam is considerably wiredrawn by passing through two small passages, one at each end of the valve, varying from $1\frac{1}{2}$ in. to $\frac{5}{8}$ in. in width in different valves. Their opponents magnify the importance of the greater weight of the valve due to the Allan port, and do not sufficiently realize the advantages of the higher cylinder pressure obtained. The weights of a plain and Allan valve, without the packing strips, and information as to steam economy, are given in the following table:

	Engine 145.	Engine 617.
Outside diameter of drivers....	68 in.	68⅞ in.
Cylinders.....	19 in. × 24 in.	18 in. × 24 in.
	Allan balanced.	Plain balanced.
Valve weight, lbs	112	112
" travel.....	5 in.	6 in.
Outside lap.....	⅞ in.	$1\frac{1}{16}$ in.
Inside clearance.....	$\frac{1}{16}$ in.	$\frac{1}{16}$ in.
Steam ports.....	$1\frac{1}{2} \times 17\frac{1}{4}$ in.	$1\frac{3}{4} \times 17\frac{1}{4}$ in.
Weight of cars, tons.....	339.7	317.5
Average speed.....	42 6	43.3
Average steam pressure, lbs..	159.9	161.0
Pounds water per dynamometer horse power per hour	32.9	32.2

The above results indicate that a valve with an Allan port ½ in. × 17¼ in. and 5-in. travel was about as efficient as a plain valve with 6-in. travel. Engine 145 would not have made as good a showing had it not been for the Allan ported valve. The Allan port enlarges the steam opening by the same number of inches for all points of cut-off, while a longer valve travel enlarges it to a certain per cent., the number of extra square inches decreasing as the cut-off grows shorter. The Allan port always leaves a wavy compression line on cards from single expansion engines. This distinguishing difference may be noted in all cards. It is probably caused by the volume of steam at about boiler pressure that is entrapped in the cavity of the valve suddenly let into that end of the cylinder which is exhausting just at the time compression begins. It meets with a pressure of, say, 10 lbs. in the cylinder, and the sudden impulse sets the indicator spring vibrating. The greater the cubical contents of the Allan port cavity the more pronounced are the reverse curves in the compression line.

Valve Travel.—An increased average cylinder pressure may be obtained by increasing the valve travel without raising the boiler pressure, and better results will be obtained by increasing both. If the valve travel is increased without increasing the outside lap, or the outside lap is not increased out of the proper proportion, not only is the port opening for a given cut-off increased, but the port is opened more quickly, the result being that the longer travel gives a higher steam pressure in the cylinders. The longer travel gives a later exhaust opening, later exhaust closure, and a larger exhaust opening, all necessary for high speeds and economy. The accompanying table gives the data for two cards, and shows a saving for the longer valve travel, as this was the only change made in the engine. The main gain is in a higher pressure throughout the steam and expansion lines, being due to wider port opening and quicker travel of valve.

Card No.	Cut-off, inches.	Speed. M. P. H.	Speed. Rev. per min.	Boiler.	M. E. P.
54	6	24	155	145	35
52	6	27	176	145	38.3
14	6.6	21	136	140	37
31	6	21	136	140	42.3

Increasing the valve travel increases the mean effective pressure by giving a greater port opening both for admission and exhaust. When the engine had 5 in. valve travel she was a "coal eater." Since the travel was increased to 5⅛ in. she has been much smarter, and has led her class in the number of miles made per ton of coal.

The following table shows the performance sheet record of the engine before and after the valve travel was changed.

5-in. Valve Travel.				5⅛-in. Valve Travel.			
1892.	Tons coal.	Miles.	Train-miles per ton.	1893.	Tons coal.	Miles.	Train-miles per ton.
Aug..	279	3,756	13.46	April.	302.5	3,683	12.17
Sept..	288	3,930	13.65	May..	249	3,807	15.26
Oct...	355	4,017	11.32	June..	122	2,781	22.80
Nov..	45	(357)	(7.94)	July..	197	3,673	18.64
Average.....			12.81	Average.....			17.22

Steam Ports.—There are a number of American engines with ports 23 in. long. The length of steam port has considerable effect on the power, speed and economy of the locomotive.

The following table gives dimensions of two classes of engines, and data from the indicator cards:

	Class Y engine. In.	Class H engine. In.
Drivers, outside diameter.....	68	69
Cylinders, stroke and diameter.....	18½ × 24	19 × 24
Valve travel	5⅜	5
Outside lap.....	$1\frac{1}{16}$	⅞
Inside clearance.....	0	$\frac{1}{16}$
Lead at 7-in. cut-off.....	$\frac{3}{16}$	$\frac{3}{16}$
Allan port.....	$\frac{1}{2} \times 23$	$\frac{1}{2} \times 17\frac{1}{4}$
Steam ports.....	$1\frac{1}{4} \times 23$	$1\frac{1}{2} \times 17\frac{1}{4}$
Exhaust ports.....	$2\frac{1}{2} \times 23$	$3 \times 17\frac{1}{4}$
Exhaust nozzle, diameter.....	4⅝	5

	Class Y. Card 11.	Class H. Card 13.	Class H. Card 16.
Steam pressure.....	180	170	180
Speed, miles per hour	50	49	44
Speed, revolutions per minute.....	247	238	214
Mean effective pressure.....	64	50.3	56
Horse power.....	531	424	424
Horse power possible.....	576	468	..
Foot-pounds per heat unit.....	66.62	68.48	71.6
Indicated water per ind. horse power per hour.....	23.48	22.87	21.84
Ditto, possible.....	21.6	20.7	..

* Synopsis of a paper read by Mr. C. H. Quereau, Engineer of Tests of the Chicago, Burlington & Quincy, at the February meeting of the Western Railway Club.

The engines are practically the same, except that the steam ports of the Class Y engine are 23 in. long, and it has a 4⅜-in. exhaust tip, while the ports of the Class H are but 17¼ in. long, and the exhaust tip is 5 in. in diameter. The steam line of card 11 was considerably nearer boiler pressure than that of card 13. The 23-in. port generated 25 per cent. more power with but 2.6 per cent. loss in economy. Had the 23-in. port been accompanied by a 5-in. exhaust pipe, the record would have stood: 576 H. P., 21.6 lbs. of water; an increase in power of 8.5 per cent., with a saving of 8.7 per cent. in fuel. On the other hand, if the 17¼-in. port of the Class H engine be lengthened to 23 in., and the 5-in. exhaust tip still retained, the result will be that a 5-in. cut-off could be used instead of 7½ in.; an increase in horse power of 10.4 per cent., and a saving of 10.6 per cent. in the amount of water and coal used.

Long Valve Travel vs. Long Steam Ports.—The foregoing comparison of cards shows the decided advantage of long steam ports for high-speed engines. The increased area through which steam may enter the cylinder assists to produce these results. This increased area may also be gained by increased valve travel.

A long, narrow steam-opening of the same area as a shorter and wider one has more inches of edge over which the steam is wire-drawn and is much less efficient. With a valve having 7-in. travel; and 1¼-in. outside lap, the port opening is about ½-in. at 6-in. cut-off. If the steam port is 17 in. long, the area of the steam opening is 8.5 sq. in. For a 5½-in. travel and ⅞-in. outside lap, the port opening is about 5-16 in.; therefore, to obtain 8.5 sq. in. steam opening, the length of the steam port for the 5½-in. travel must be 27 in. In addition to the disadvantage of using such a long port, it should not be forgotten that the 27-in. port and 5½ in. travel make it necessary to use 54¾ in. of port edge over which the steam is wire-drawn, while the 17-in. port and 7 in. travel give but 35 in., making the latter much more effective. The long travel has the advantages also of later exhaust opening, later exhaust closure, and a quicker and wider opening for the admission of steam. The best arrangement, as far as economical steam distribution and power at high speeds are concerned, would be a long valve travel *and* long ports. A 20-in. port and 6½-in. or even 7-in. travel can be successfully used for high-speed engines, and frequently by so doing the cylinders can be economically reduced and the counter balance lightened; or the diameter of the drivers increased, securing lighter counterbalance and better steam distribution.

Lead.—Compression will furnish all the cushion necessary. One of the most common defects with locomotives is that there is too much compression. The proper object of lead is to secure full boiler pressure in the clearance spaces and provide as large a port opening as possible just as or after the crank passes the center, not before. If pressure is allowed in front of the piston before it reaches the end of the stroke, it will take up the lost motion in the parts and block the engine, diminishing its speed. If this pressure is caused by the compression of steam which was left in the cylinder when the exhaust closed, the pressure will increase comparatively slowly and the lost motion be taken up gradually. If the speed is slow and there is too high pressure apposing the piston, the crank pin will pass each center with a thump. The Stevenson link motion gives an increasing lead as the cut-off is shortened, the increase depending mainly on the length of the eccentric blades. All the passenger engines on the P., Ft. W. & C. Ry., except those which run backward considerably, have their valves set with a small constant lead. This was done to overcome a disagreeable fore and aft motion at high speeds, which it did successfully. On others the Allan gear is used. The lead used with these is from 1-16-in. to ⅛-in. (.063-in. to .125-in.). In Germany, France and England the valve gears most generally used are those which give a constant lead for all cut-offs. The lead on German engines with these gears is from .12-in. to .16-in. for Allan valves, and from .16-in. to .2-in. for plain valves; in France it is about .2-in.; in England, from .2-in. to .25-in.

The clearance space to be filled, and the length of time required to fill it, are always the same for a given engine. At 60 miles an hour there is one-fourth the time in which to fill it that there is at 15 miles an hour, therefore if a sixteenth of an inch is sufficient at full gear and slow speeds it is not sufficient at 6-inch cut-off and high speeds. The lead should be variable, and increase as the engine is hooked up and the speed increases. Foreign engineers have chosen a constant lead adjusted to give the best results at high speed.

Lead Effected by Allan Valve.—If a certain amount of lead at full gear is the best for a plain valve, about half that amount will answer the same purpose if the valve has an Allan port. The effect of this reduction of lead is to change the cut-off for a given notch in the quadrant, and to delay both the point of exhaust opening and closure.

By using an Allan valve and reducing the lead, the steam is expanded somewhat further, and compression begins somewhat later, as is done by a longer valve travel.

DATA FOR CARDS TAKEN FROM DIFFERENT LEADS.

CARD.	18.	2.
Speed, M. P. H.	22	24
Lead at 7-inch cut-off	8-32 in.	11-32 in.
M. E. P., actual	83	75.8
"having same steam and expansion as Card 2	81	....

Gain in M. E. P., 5.2 = 6.9 per cent.

The cards show ¾ in. later exhaust opening, 1 in. later exhaust closure, and a consequent gain of 5.2 lbs. mean effective pressure, nearly 7 per cent. due to smaller lead necessary for an Allan valve.

Lead Produces Compression.—Several cards were taken, one each at 40 miles an hour, at 45 miles an hour, and at 50 miles an hour, when the engine had $\frac{1}{10}$ in. lead in full gear, and about $\frac{1}{32}$ in. in mid-gear, and the cab had the palsey. The lead in all three cards opens about two inches before the piston reaches the end of the stroke. The compression line rises from this point quite suddenly and rapidly, reaching 214 lbs. in card 19, at 50 miles an hour, 49 lbs. above boiler pressure. Not only does a correct lead make the engine freer and more speedy when under way, but is an important item in increasing the average speed.

The data for cards, each differing from the others only by the changes made in the lead, unless there be a slight difference in cut-off, speed 55 miles an hour, 267.6 revolutions per minute, will be found in the following table.

Card.	Lead for Cut-Off.	M. E. P.	Horse Power.	Ind. Wtr. per Ind. H. P.
20	11-32	37.9	399	21.8
62	9-32	37.3	393	21.3
9	Scant 7-32	43.5	458	21.1

The economy of the engine, as figured from the indicator cards, increases slightly as the lead is reduced, and the best economy is obtained when the engine is riding smoothly. If there were no saving in steam, it seems evident that there would be a saving in repairs for the smooth-running engine, also increased capacity for speed.

It is advisable to reduce the mid-gear lead by moving the back-up eccentric away from the crank pin. This adjustment does not appreciably alter the lead for full stroke go-ahead, because, for this position of the reverse lever the rocker block is in line with the knuckle joint of the go-ahead eccentric blade.

There is less vibration of an engine at high speeds when full gear lead is $\frac{1}{64}$ in. The reduction of the mid-gear lead, secured by moving the back up eccentric, makes the cut off somewhat shorter than before for the same notch in the quadrant.

A reduced mid-gear lead, secured by adjusting the back-up eccentric is used by the P., Ft. W. & C. R. R. on such of its passenger engines as have the Stevenson valve gear; by the C., C. C. & St. L. on its Class Y passenger engines; by the H. & St. J. for all its locomotives. It has been used for about a year by the C., B. & Q. for its high-speed passenger engines with Allan valves, with uniform success.

Throttle v. Reverse Lever.—Foreign engineers say that we run our locomotives with open throttles only when taking indicator cards. Most runners persist in running with a partially opened throttle because it is so much easier to handle the throttle than the reverse lever.

The table below gives the data for four cards, shows the difference in power and indicated economy between the full open and partly open throttle. Cards 4 and 13 show an apparent saving of 18 per cent., and 2 and 44 show a saving of 17.7 per cent., in favor of the full open throttle.

	Card 4.	Card 13.	Card 2.	Card 44.
Throttle opening	⅛	Full op'n'g	¼	Full op'n'g
Speed, miles per hour	58	58	61	61
Speed, revolutions per minute	250	250	263	263
Mean effective pressure	50.4	50.1	40.7	40.7
Horse-power	445.6	443	378.5	378.5
Indicated water per indicated horse-power per hour	24.5	20.1	25.34	20 86
Foot-pounds per heat unit	63.33	77.9	61.83	75.10

These cards show that the open throttle gives more nearly boiler pressure than the partly open throttle, and that with an open throttle more work is obtained from the same amount of steam. The mean effective pressure is the same, the difference in the pressure of the steam when exhaust opens shows a saving of 17.6 per cent for the open throttle. A comparison of the indicated water may not measure an engine's economy when the cards used are taken at cut-offs varying considerably, the condensation is unequal, the drier throttled steam gives less condensation and the amount of condensation is not shown by the cards. Yet the results of careful tests have shown that throttling is uneconomical, even when the cut-off for full throttle is as short as one-fifth of the stroke. When the practice of distributing steam by the throttle is allowed, higher boiler pressure, longer valve travel, or longer steam ports, will result simply in a little closer throttling and a finer notched throttle quadrant.

Objections to Long Steam Ports, Long Valve Travel and Full Throttle.—Foreign valve travel averages from 4 in. to 4½ in., rarely 5 in., and the steam ports are short; to this design, with its small steam chests, may be attributed the fact that slide valves are not balanced abroad. Theoretically, long valve travel, large steam passages and full throttle are advantageous, especially so for high speed engines. A valve having 5-in. travel and ⅞-in. outside lap gives a port opening of 9-32-in. as the maximum width at 5-in. cut-off. If the ports are 17¼-in. long, this gives 4.9 sq. in. of steam opening, equivalent to a 2½-in. dry pipe. As the maximum opening is obtained only for an instant, increasing from and decreasing to zero, it is really equivalent to less than 3 sq. in., and that with 35 in. of port edge. Drivers as large as 78 in. in diameter make 215 revolutions per minute, 3.6 per second, at a speed of 50 miles an hour. In an 18-in. cylinder, with 8 per cent. clearance, there are 1,762 cu. in. at 5-in. cut-off to be filled with steam, which should be at boiler pressure. At 50 miles an hour an engine with the above proportions is expected to realize boiler pressure in a cubic foot of space in one-third of a second through an opening less than 3 sq. in. in area, with 35 ins. of wire drawing port edge.

Inside Clearance.—The loss from inside clearance at the exhaust end is insignificant when compared with the gain from inside clearance at the compression end. To find the proper inside clearance for a high speed engine adjust the lead till the indicator cards show a smooth compression line, increase the inside clearance by not less than $\frac{1}{16}$ in. on each end at a time, as long as the card shows a gain in area by so doing. The effect of $\frac{1}{32}$ in. inside clearance is scarcely discernible at 6-in. cut off. Inside clearance of from ⅛ in to ¼ in. on each end is not uncommon on high speed locomotives. The longer the travel and the smaller the lead, the less the inside clearance needed. Inside clearance has but little effect on back pressure; it is almost entirely controlled by the size of the exhaust passages and tip.

Conclusions.—If economy as well as speed is desired, locomotives should be run with wide-open throttle, otherwise the proportions of the valve gear are of minor importance. Boilers and grate areas must be larger, and heating surface greater for high than for slow speed engines of the same class.

To overcome the decrease in average cylinder pressure due to increased speed, the following remedies may be used: Increased boiler pressure, larger drivers, Allan valves, increased valve travel, increased length of ports, proper adjustment of lead to reduce compression, sufficient inside clearance.

The following table gives the principal dimensions which affect steam distribution, from the standard locomotive of seven trunk lines and four prominent locomotive builders, both for 1882 and 1893:

	1882.	1893.	Increase. Per cent.
Grate area, square feet	16.95	24.62	45.2
Total heating surface, square feet	1,161	1,616	39.2
Diameter of boiler, inches	50.5	57	6.5
Outside diameter of drivers, inches	64.6	71	5.4
Steam pressure, pounds above atmosphere	135	174.5	29.2
Steam ports	1.18 × 15.9	1.37 × 17.1	....
Steam ports area, square inches	18.76	23.43	25

The table further shows: in 1882, four unbalanced valves and four balanced; in 1893, all valves were balanced; in 1882, no Allan valves; in 1893, five Allan and five plain valves; in 1882 valve travel 5.32 in., in 1893 5.57 in., increase ¼ in.; lead—two the same in 1893 as 1882, two increased and six diminished since 1882; in both cases where the lead remains the same a plain valve is used; of the two cases of increased lead, one is plain and one an Allan valve; of the six cases of decreased lead, four are now Allan and two plain valves; inside lap, 1882, five; 1893, four: line and line, 1882, five; 1893, four; inside clearance, 1882, none; 1893, two: inside lap reduced, or inside clearance given, since 1882, five; inside lap increased since 1882, two; inside lap, no change since 1882, three. In the two cases where the inside lap has been increased, the valve travel has been increased from five inches to six inches and six and one-eighth inches respectively, so that as far as the effect on compression is concerned, the change has been to increase the inside clearance. So that really the record should stand: Inside lap reduced, or inside clearance given, since 1882, seven: inside lap, no change, three. The practical and theoretical conclusions make a well-matched team, but are hitched tandem, the theoretical as leader.

Compound Locomotives in Fast Passenger Service.—The following table is compiled from the results of careful tests of simple and compound locomotives in high-speed passenger service, made by the C., B. & Q. and other roads, which are comparatively level:

Locomotive.	Average speed excluding stops, M. P. H.	Diameter of drivers.	Pounds of water per ton-mile of cars.	Weight of cars, Tons.
Simple, 18×24 in.	43.2	69 in.	1.02	318
" 19×24 "	42.6	68 "	1.07	346
" 19×24 "	43.1	62 "	1.06	367
Compound, two cylinder	42.6	62 "	1.17	336
Compound, four-cylinder	42.3	72 "	1.10	388
Compound, four-cylinder	36.3	72 "	1.18	...

The above shows that any of the simple engines were more economical in the use of steam than any of the compounds, whether two or four cylinder, for high speed service. The economy of compounds is due mainly to three advantages they have over simple engines—greater expansion of the steam used, less loss by cylinder condensation, and a milder draft. It can be shown that they largely lose these advantages at high speeds, and, in addition, have certain disadvantages. At high speed the cut-offs are comparatively short, the steam is therefore expanded in the simple engine about as much as can be done economically. Cylinder condensation decreases as the speed increases, therefore the economy of the compound decreases similarly. The smaller exhaust tips used on compounds will explain the higher back-pressure of compounds when compared with simple. A compound having cylinders 20 in. and 29 in. by 24 in. is considered the equivalent of a single expansion engine having 19-in. by 24-in. cylinders. The area of a 19-in. piston is 283.5 sq. in.; of a 29-in. piston 660.5 sq. in. The low-pressure cylinder has to exhaust nearly two and a half times as many cubic inches of steam as the 19-in. cylinder.

At high speed the back pressure of a compound locomotive is higher than of a simple at high speeds. This fact will explain why the compound loses at high speeds the mild draft it has at lower speeds. A compound it not necessarily as economical as a simple engine at high speeds, though it is admittedly so at slow speeds. The following table shows how the economy of compound locomotives decreases with increase of speed Cards were taken every two minutes; average speed 40 miles an hour; total weight engine and train, 476 tons. The cards were taken from a two-cylinder compound, but the same is true of four cylinder compounds.

Speed.		Average indicated water.
Revolutions	M. P. H.	
104 to 152	21.3 to 31 2	18.33
160 to 200	32.9 to 41.1	18.90
216 to 240	44.4 to 49 3	19.7
256 to 272	52.6 to 55.9	21.4

The column of averages indicates that the economy decreases faster than the increasing speed after 150 revolutions per minute is reached. The steam economy of well-designed, single expansion locomotives, as figured from indicator cards, increases as the speed increases within the limits of usual passenger train speeds. The results of calculations from a few cards are here given:

Card No.	SPEED.		Indicated Water.
	Revolutions	M. P. H.	
17	151	31	21.70
31	219	45	20.91
20	253	52	20 52
23	307	63	20.23
46	321	66	20.01

The C., B. & Q. two-cylinder compound, which was about 30 per cent. less economical than simple engines of the same class when tested in passenger service, has since been shown to be 15 per cent. more economical in freight service than the best single expansion engine, and 29 per cent. more economical than the average record of 40 simple engines of the same class, in the same pool, and on the same division. The advantages which compounds retain at high speeds are that the turning force at the crank pins is more uniform.

Indicator cards from the P. R. R. compound, taken at speeds of 50 and 59 miles an hour show the best steam distribution I have had an opportunity of studying. For such high speeds it is probably better than that of any other compound locomotive yet built. This locomotive would be more powerful and economical for high speed and heavy trains than the simple locomotive doing the same work. A comparison of indicator cards and the dimensions in the above table affords one of the best object lessons enforcing the importance of proper valve gear dimensions and the advantage of liberal valve travel and inside clearance.

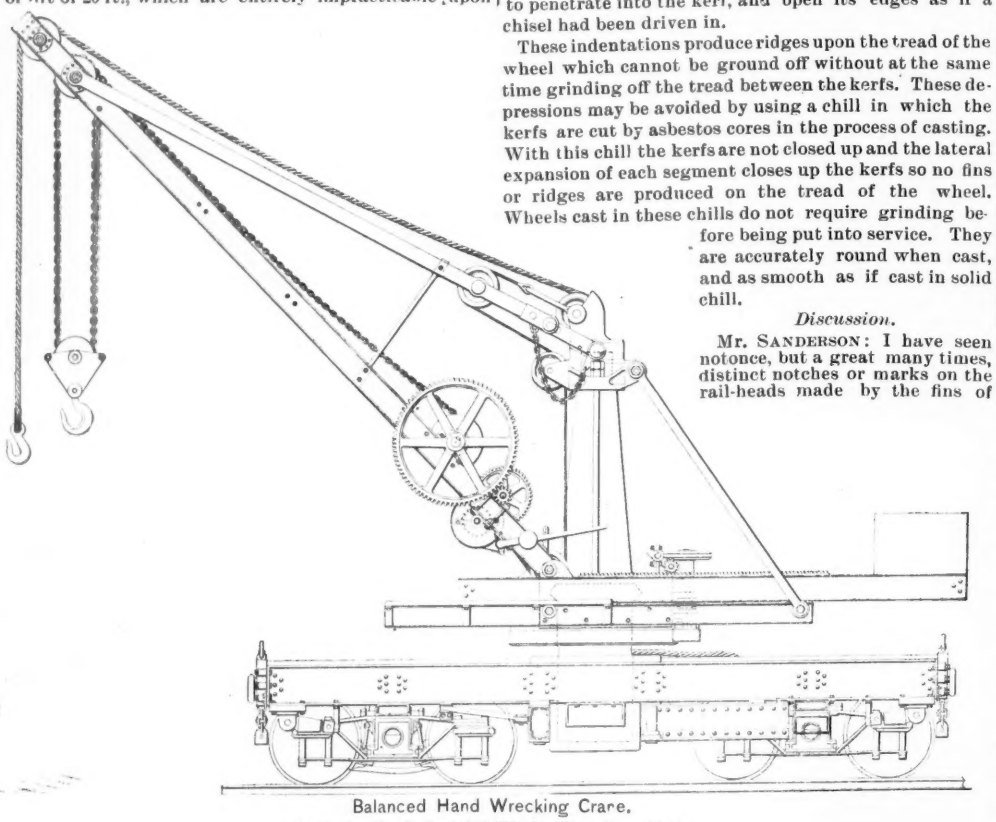
The paper contains an elaborate table indicating the changes in the dimensions of locomotives, which effect most their capacity for high speed, which have been made in the last 12 years.

Balanced Hand Wrecking Crane.

The crane shown in the accompanying engraving is one built on a new design, recently made by the Industrial Works, Bay City, Mich.

The essential features of a crane for wrecking purposes and for operation by hand power are that it shall be light and easily manipulated. In fulfilling these requirements it frequently occurs that the machine wil lift but a light load, rendering it almost useless when it is most required. The ordinary pillar crane mounted upon a wooden or iron car, although of great value for light work, is so limited and variable in its capacity as to be quite unsatisfactory for many jobs. Such a machine may lift ahead a load of perhaps ten tons, but with the jib at right angles to the car body, unless outriggers are used it cannot lift one-third of this.

The features of the crane herewith shown are: With an easily adjustable counterbalance to the jib, and with the load in any position, the crane may lift nearly its full capacity with the jib at right angles to the car. The crane has an extended radius of 18 ft. and a height of lift of 20 ft., which are entirely impracticable upon



Balanced Hand Wrecking Crane.
Made by the Industrial Works, Bay City, Mich.

an ordinarily constructed pillar crane mounted on a car without counterweight. This machine may work with equal facility at either end of the car, and it is provided with an independent locomotive pulling attachment. It is provided with a heavy counterweight in the car body itself, and it has swinging locking beams so that it is complete in its equipment.

The machine is made in capacities from 10 to 20 tons. In traveling the jib may be lowered and the counterweight drawn in. In its construction metal only is used. Particular attention has been given to details giving safety to the attendants and speed of operation. There are provided two speeds of hoist for the load and automatic self-sustaining devices for holding the load in any position. All bearings having to sustain great pressure are provided with hard steel roller bushings. When operated with heavy loads the machine may be slewed through the operation of the crank handles. But in ordinary service this attachment is not used, the crane being slewed by a hand rope from the end of the jib. The counterweight is thrust in and out through the crank handles, and the jib, with the load in any position, may be quickly balanced, allowing the jib to swing a complete circle if desirable.

Southern and Southwestern Railway Club.

GRINDING OF WHEELS CAST IN CONTRACTING CHILLS.

At the regular meeting of this club on Jan. 18, the above-named subject formed the first topic for discussion. The Committee reported that a majority of those corresponded with are of the opinion that wheels cast in contracting chills should have a partial grinding to level the fins or ridges caused by the chills. As to the deleterious effects incident to unusual wear of rail head, it was the general opinion that there was no appreciable difference with wheels cast in contracting chills.

A letter from John R. Whitney brought out the following features of the Whitney chill.

The grinding of chilled cast wheels has been pressed upon the attention of the railroad public by two classes of very earnest advocates, viz.: those who use contracting chills in which the kerfs are cut mechanically by sawing, and some of those who use the solid chills. The first are obliged to grind, because the kerfs are so wide that they produce very large ridges on the tread of the wheels, which must be removed. The other, because they find it very difficult to make a wheel as accurately round as has been required since the introduction of the contracting chill. In other words, the one can make a round wheel which is not smooth, and the other can make a smooth wheel which is not round. With both classes, however, a considerable portion of the best wearing part of the tread is removed by grinding, and the life of the wheel is impaired to just that extent.

In the case of wheels cast in contracting chills with sawed kerfs, this is not so self-evident, as a brief explanation will show. When such a chill is cast it is cored out, and turned to the diameter and templet required. This coring reduces the chilling surface by a thickness of about ⅝ to ¾ of an inch. When such a chill is used, each segment is heated through at the kerf where it is thinnest, and afterward through the thicker parts, the chilling face of the chill becoming a series of curves, and the *expansion* of the molten iron causes it to penetrate into the kerf, and open its edges as if a chisel had been driven in.

These indentations produce ridges upon the tread of the wheel which cannot be ground off without at the same time grinding off the tread between the kerfs. These depressions may be avoided by using a chill in which the kerfs are cut by asbestos cores in the process of casting. With this chill the kerfs are not closed up and the lateral expansion of each segment closes up the kerfs so no fins or ridges are produced on the tread of the wheel. Wheels cast in these chills do not require grinding before being put into service. They are accurately round when cast, and as smooth as if cast in solid chill.

Discussion.

MR. SANDERSON: I have seen notonce, but a great many times, distinct notches or marks on the rail-heads made by the fins of wheels. The wear of rails is an important item in the expense of any railroad company, and Master Car Builders and motive power officers should consider other departments, and not recommend anything that will tend to increase expenses of the maintenance of the track. I recommend that wheels be ground partially before put in service. We might argue that truing wheels would reduce the chill on high parts, cutting us out of that much wear, but I am satisfied that this will be of advantage. We grind wheels sufficiently to do away with any nicking of the rail heads, and so that in running the hand around the wheel no inequality can be noticed.

MR. MEEHAN: It seems to me, if there is nothing besides this the application of the brake would remove it before doing much harm.

MR. ROBERTS: The Whitney cost to grind, ten to fifteen cents a piece. There is a very slight ridge in the Whitney wheel, on account of the small opening of the chill.

PRESIDENT: I was antagonistic to the contracting chill at first, for the reason that it causes the wheels to be cast in a series of facets. I never have seen a round wheel out of a contracting chill. This matter resolves itself down to the degree to which you will have your wheels ground. From one manufacturer from which we are buying wheels we pay 20 cents extra for boring and grinding. They are ground on an arbor, come out perfectly true, and I believe it is money well expended. So far as holding manufacturers down to a limit, that is a matter of commercial interchange, that I do not think this Club has anything to deal with. I think it should be the sense of the Club that wheels be ground in order to remove the fin.

MR. SANDERSON: As the fins are upon the flange also, the rail wear on sharp curvature amounts to a great deal.

MR. HOOKER: I want to introduce a resolution that all wheels should be first bored and then ground on an arbor.

PRESIDENT: I take a little exception to that. I think it should be "that wheels be ground in such a manner as to insure the removal of all ribs or fins and, so far as possible, ridges on the wheels."

MR. HOOKER: I will modify the motion in this way: "That it be the sense of the Club that wheels should be ground in such a way as to insure removal of the fins, both on tread and flange, and at the same time insure circular periphery on the tread." Carried.

INTERCHANGE RULES.

MR. SANDERSON: A member of the Committee said that the trouble was of a nature that neither the Arbitration Committee nor the members of the Club had power to prevent—questions of veracity and stupidity. The question of veracity he would leave to the parsons. For the question of stupidity, they were responsible for appointing men who have not been properly trained and taught. The question for the Committee to discuss was the revision and rearrangement of the Book of Rules.

President LEEDS: Do not speak too harshly, I am on that Committee. We discussed that question. I think it would be well to put rules under subheadings, condense them, and edit the code anew.

Mr. ROBERTS: I think it would remove a great many difficulties if our rules were more specific. The inspectors should have the right kind of information. The rules should cover what is intended. I think we should have in the back of our books the Interstate Commerce Law.

Mr. SANDERSON: The fact that wrong material used has run for two years does not, or should not, relieve the road making the repairs for using wrong material.

Mr. HOOKER: I would call the attention of the Committee to the use of oil-boxes in which the oil-box bolts are not housed into the box, but simply bearing against it. If bolt head breaks and bolt drops out, there is nothing to hold the box in its place.

BALANCE SLIDE VALVES.

Mr. SANDERSON, in referring to his paper on "Balancing Slide Valves," which he had presented, said he would like to go distinctly on record as not putting forward his rule as a general rule, but only for particular valves, or for valves very nearly of the dimensions and proportions given in the sketches. He does not even wish to go on record as saying that he should balance up to this in each particular case, as complications due to increased size of back of valve and increased size of steam chest would probably cause more trouble than could be saved by the larger amount of balance obtained.

COUNTERBALANCING.

Mr. LEEDS invited members to express their ideas on the reports in the technical papers on the tests on counterbalancing at Purdue University. He said that the impression that will obtain with the management of railroads through these reports should be corrected. He took exception to the claim that a perfectly balanced engine was one in which the entire revolving and reciprocating parts were in balance, and the impression that he believed will be carried to managements that this is very generally the condition of our engines, or objective point at which we aim; and he protested against the comments on the experiment that there has been a revelation not only of facts, but principles, that were unknown to the mechanical world previous to this demonstration, of the action of counterbalances. He believes it has been a recognized fact, antedating the experience of any of us, that these agencies were all at work, and in just exactly the line demonstrated; that it has always been recognized by thinking men that an excess of counterbalances was injurious to track, and that it has been the aim of all designers to counterbalance the reciprocating parts to just as low a degree compatible with a reasonably steady running engine, and for no other cause than the fact that all counterbalances beyond the rotating parts were at the expense of the roadbed. He said that the destructive agency of a distribution of the entire weight to be counterbalanced over different wheels, making up by a surplus in one pair of wheels for the deficiency in the other, had been recognized. To prevent the destructive action of counterbalance of reciprocating parts, the instructions have been to balance only two thirds of such reciprocating parts, which has been found sufficient to preserve the engine from undue destruction of parts from the action of reciprocating parts, and to obtain a reasonable degree of comfort in riding the engine, and the deficit between that and a perfectly counterbalanced engine has been yielded, with due respect to the protection of the track from unnecessary punishment from the action of a hammer blow.

I do not think the demonstration made in these experiments will change the system of counterbalancing to any extent, and the object that I have in making any remarks on it is to remove the impression that it is our practice, or that it will be our practice, to balance fully up to the reciprocating parts, and by doing so obtain an engine that will lift herself from the rail at 40 miles per hour, especially with the size wheel that is under this test engine. It may result in a greater effort to reduce the weight of reciprocating parts, although I think that this has been a study heretofore that has not been neglected. At the same time it may result in the use of wrought iron, at an additional first cost of reciprocating parts, in order to obtain better results and less expense in maintenance. I would suggest that this be a matter for further discussion without the appointment of a committee, that each member may come prepared to ventilate his views.

The following subjects were selected for the meeting of April 19: 1. "Construction of Ends of Box Cars; the Cause of and Remedy for the Bulging Out of Ends of Box Cars." 2. "Is the Collar or Collarless Axle the Best Adapted to General Rolling Stock Service?" 3. "The Relative Strength of Different Patterns of Metallic and Composite and Wooden Brake Beams Under Service Strains." 4. "The Most Improved Methods for Rapidly Cleaning Soot and Cinders from Inside of Locomotive Boiler Tubes while Engines are in Engine Houses." 5. "Soft Plugs for Crown Sheets of Fireboxes; Best Form and How to Keep Them Effective."

Long or Short Indicator Connections.

Some interesting experiments have recently been made at Purdue University, under the direction of Professor Goss, with the object of determining the effect on the diagram of different pipe connections to indicators. These tests were suggested by the fact that in road tests of locomotives the conditions are usually such as to require considerable piping to bring the indicator to a position where it can be conveniently operated, while in laboratory tests the indicators can be connected close to the cylinder.

In order to determine whether the actual conditions are fairly represented in both cases, two indicators were attached to one end of a cylinder of the laboratory locomotive, one indicator cock being closely connected by means of a ¾-in. short nipple and a ¾ in. by ½ in. elbow, and the other indicator cock placed in the usual position on the top of the steam chest and connected with the side of the cylinder by a ¾ in. short nipple, a ¾-in. elbow, 3½ ft. of ¾-in. pipe and a ¾ in. by ½ in. elbow. The pipe was covered by asbestos paper and hair felt.

Diagrams were taken simultaneously from the two instruments at various speeds, after which the position

of the instruments was reversed and the work repeated in order to check any errors due to the instruments.

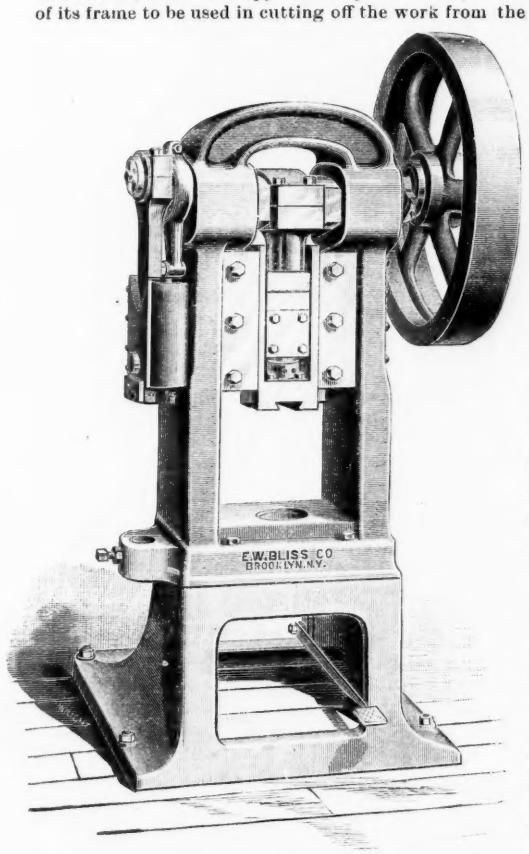
The conclusions arrived at are: 1. That at slow speeds the cards are practically identical. 2. That as the speed increases a difference appears which becomes quite perceptible at 212 revolutions a minute, and pronounced at 320 revolutions a minute. 3. That when the speed is such as to cause a difference the diagram from the indicator in the pipe is larger than the one from the indicator which is closely connected, or in other words, the mean effective pressure is increased by lengthening the connections.

The difference, as shown by a comparison of the cards, seems to indicate that with long connections the instrument is tardy in its action. This is brought out by the fact that the difference in pressure is very slight during parts of the stroke in which the change in pressure is very gradual, as in admission or exhaust, or at points near the end of the stroke where the piston moves slowly, while during the more rapid changes, the instrument with long connections lags behind, the expansion line being higher and the compression line lower than with the other instrument.

While satisfied with the accuracy of his conclusions, Professor Goss is not ready to state the amount of difference to be expected, which, of course, is liable to vary with the boiler pressure, and the points of cut off and compression as well as with the speed at which the engine is run and the length and size of piping.

Trimming Press for Drop Forgings.

A press recently designed by the E. W. Bliss Co., of Brooklyn, N. Y., is intended for use in the forge shop where hot metal is to be trimmed. The machine is fitted with the Bliss clutch and a patented adjustment in the slide, and has a supplementary slide in the side of its frame to be used in cutting off the work from the



bar after it is forged and trimmed. This is considered a new feature. These presses are built in several sizes and are usually made with fly wheels, as forgings are required to be trimmed quickly and a high speed machine becomes necessary. The engraving represents a No. 74½ press, which has a 4-in. stroke, 4-in. adjustment and is 15 in. from bed to end of slide when up; distance between uprights is 22 in. It carries a 900 lb. flywheel, the total weight being about 5,500 lbs. The dimensions can be modified to suit special requirements if it is necessary, and they can also be geared for cold trimming.

Chicago Freight Traffic.

The Western roads report an improvement in their outward freight the past week. The iron establishments show a marked increase in demand. The tendency of miscellaneous shipments to increase is more pronounced. In the inbound traffic the flour movement showed a heavy shrinkage from last year. Minnesota mills are shipping via Northern routes to Atlantic markets because of the lower rates. The grain movement was a surprise, the aggregate by all lines footing up 3,875,000 bushels against 3,400,000 bushels the preceding week, and 3,463,000 the week ending March 1, 1893. The free arrivals of grain were a surprise to the trade and the railroad officials because of the low prices, and the receivers are again predicting that an immediate decrease in grain traffic will follow. There is now about 40,000,000 bushels of grain in Chicago elevators and on vessels in the harbor; therefore there is little room for more, and the shipments eastward by rail are not expected to equal the receipts. Low prices are also expected to act as a bar to continued heavy shipments from the country.

The following shows the deliveries of grain (bushels) at Chicago by the leading Western railroads for the month of February, with comparisons for the two preceding years:

	1894.	1893.	1892.
C. & N. W.	3,298,000	2,513,000	2,051,000
Ill. Cent.	1,606,000	1,745,000	1,338,000
C., R. I. & P.	1,621,000	616,000	2,199,000
C., B. & Q.	3,000,000	3,285,000	2,141,000
C. & Alton	682,000	410,000	410,000
C. & E. Ill.	264,000	530,000	374,000
C., M. & St. P.	2,144,000	1,267,000	2,493,000
Wabash	387,000	322,000	418,000
C. & G. W.	488,000	67,000	470,000
A., T. & S. Fe	656,000	1,031,000	443,000
L., N. A. & C.	21,000	.....	3,000
Totals	14,167,000	12,326,000	12,370,000

The following shows the deliveries of flour at Chicago by the leading Western railroads for the month of February and comparisons with the two preceding years (barrels):

	1894.	1893.	1892.
C. & N. W.	61,464	137,611	123,716
Ill. Cent.	900	5,706	1,163
C., R. I. & P.	11,800	12,585	10,100
C., B. & Q.	20,821	77,976	71,910
C. & Alton	4,500	10,955	8,206
C. & E. Ill.	459	750	125
C., M. & St. P.	56,975	155,400	103,275
Wabash	1,500	5,430	5,000
C. & G. W.	61,399	46,706	58,993
A., T. & S. Fe	750	2,700	130
L., N. A. & C.	.....	.....	352
Totals	220,499	455,813	383,010

There was an improvement in the livestock traffic over the week immediately preceding, and a large increase over the one ending March 6, 1893. February shows a good increase over the corresponding month last year, but a decrease from the same time in the two preceding years. As the majority of the stock cars now in use are much larger than those used two and three years ago, the shrinkage in the number received the present year does not represent a corresponding loss in traffic.

The deliveries of livestock at Chicago by all railroads for the month of February, and the corresponding time the two preceding years, are as follows:

	1894.	1893.	1892.
A., T. & S. Fe	902	671	1,190
C. & Alton	1,221	1,588	1,196
C., B. & Q.	5,019	4,248	5,907
C. & E. Ill.	300	332	305
C., M. & St. P.	3,304	3,422	3,743
C. & N. W.	4,692	4,229	5,541
C., R. I. & P.	2,361	1,795	3,023
C. & G. W.	655	629	939
Ill. Cent.	1,782	1,495	2,264
Wabash	1,110	1,574	816
Wis. Cent.	216	199	93
Other roads	266	178	180
Total cars	21,858	20,160	25,197

The shipments of livestock from Chicago by the eastbound railroads for the month of February for the past three years were as follows (carloads):

	1894.	1893.	1892.
B. & O.	471	599	569
C. & Erie	412	232	279
C. & Grd. Tr.	1,449	1,174	1,243
L. S. & M. S.	1,971	2,114	2,676
Mich. Cent.	458	787	945
N. Y., C. & St. L.	300	348	1,798
P. C. C. & St. L.	116	120	247
P., Ft. W. & C.	1,234	974	1,542
Total cars	6,411	6,348	9,299

Foreign Railroad Notes.

Paris is to have a new cable street railroad, to run from the Place Cadet to Montmartre, and to be modeled somewhat after the Belleville road. Two other lines also are under consideration.

The railroad between Jaffa and Jerusalem, which has been in operation about 15 months, is now being run at a loss of about $120 a day. Two passenger and two freight trains are run each way daily.

Third-class cars for the Prussian State Railroads are to be built on a new system hereafter, having a longitudinal passage on one side, but preserving the compartments and the side entrances. They are to to be made more comfortable than the old ones.

Denmark at the beginning of this year established a Ministry of Public Works, to which the railroads of the kingdom will report. Heretofore they have been subject to the Ministry of the Interior. Inventors of car couplers and the like who wish to permit Denmark to share the advantages of their contrivances may address H. P. Ingerslev, the first Minister of the new department.

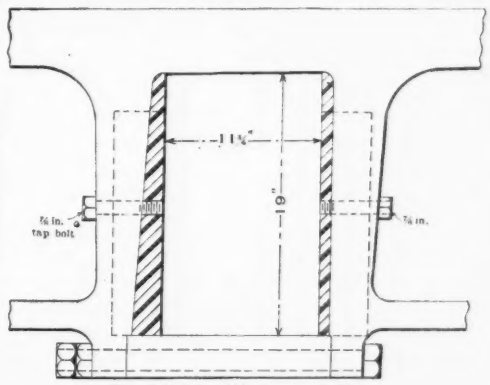
The Russian Ministry of Transportation directs that there must be a considerable increase in the number of car compartments reserved for ladies. The seats in these compartments must be made more comfortable not only in the second class, but in the third class cars, and provision for washing hands must be made. Further, compartments must be set aside for women who smoke! What with three classes, separate compartments for men and for women, and for men smokers and women smokers, we have 12 different kinds of accommodation required for a train which often will not have 12 passengers.

The Germans have completed three miles of the railroad in the East African possessions which is to extend from Tanga, on the coast, toward the Kilimandjaro mountain, and boast of their advantage over the adj a cent English colony of Mombassa, which, they say, has finished but five-eighths mile of its railroad, and got to the end of its money. The natives employed on the work are said carry the empty wheelbarrows on their heads, improving thus on the old story, which tells how the men filled them, and then put them on their heads loaded.

Germany exported 37,548 metrical tons of railroad joints and steel ties in 1893, against 39,558 in 1892 and 63,406 in 1891; also 87,300 tons of rails, against 113,712 in 1892 and 142,846 in 1891—not large quantities in any of the years. The value of the exports of railroad iron of all kinds was $2,757,600 last year and $3,499,200 in 1891. The weight of locomotives, including road engines, *imported* was 1,967 tons last year and 4,986 the year before; the *exports*, 4,958 tons, against 5,256. Imports of other railroad vehicles (cars, naturally) were 84 pieces in 1893 and 483 in 1892; exports, 4,275, against 3,800. Of all other machinery (not railroad) 38,745 tons were imported and 88,360 exported last year, an increase in both imports and exports over the previous year.

Chicago, Burlington & Quincy Driving Box Wedge.

The motive power department of the Chicago, Burlington & Quincy has been experimenting for the past two years with a fixed driving box wedge and shoe. Our illustration shows the arrangement as adapted to the class *H* engines of that road. Both wedge and shoe are of the usual form, but, instead of being provided with a means for vertical adjustment, are restrained from vertical motion. Adjustment is made by inserting lines behind the wedge or shoe as required. Both are neatly fitted vertically and drawn against the legs of the pedestal by means of tap bolts applied as shown. The device has given excellent satisfaction and is now being applied to all locomotives as occasion offers.



Fixed Driving Wedge and Shoe.

The success of the arrangement is doubtless due, in a measure, to the fact that it practically places the adjustment of driving box wedges beyond the control of the engineman and makes it essentially a shop job. The setting of wedges is not so simple a matter that it can be done with uniform success on the road, and it should be attended to by a man familiar with the work. The arrangement also obviates any possibility of the wedges working tight or loose while on the road and causing the box to stick or thump. Another feature of this device is that wedges are not likely to be set too tightly, as can easily be done with the usual wedge.

The Ben Nevis Railroad.

This railroad is to run from the base to the summit of the Ben Nevis Mountain, in Scotland, which is 24 miles in circumference and rises abruptly from a plain quite close to the new West Highland Railway and to a height of 4,406 ft. above sea level. It will depend entirely for patronage upon the pleasure-seeking public. Its total length will be about four miles, with a carriage road at the lower end of about a mile to connect with the West Highland Line. The permanent way will consist of two outer rails and a center rack-rail laid on sleepers securely framed together by longitudinal runners, which framed track will be anchored to the masonry foundations at regular intervals. The maximum gradient will be 1 in 2.62 for a length of 1,800 ft The whole undertaking, it is estimated, will cost between $125,000 and $150,000. The maximum gradient on the Mount Pilatus Railroad is 1 in 2.2 for two thirds o. its length, and that on the Righi Line is 1 in 4 for one-third of its length. The mechanical arrangements will be similar to those which have been in use on the Continental railroads for years. A summary of the proposed road is as follows: Length of carriage road, one mile; length of railroad, four miles; maximum gradient, 1 in 2.62; minimum radii of curves, 396 ft.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The New York Chamber of Commerce has unanimously adopted a resolution that a rapid transit railroad should be built by the city directly. This plan was proposed by Ex-Mayor Abram S. Hewitt at the regular meeting last week, and after a strong speech by him in its favor the resolution was adopted as a substitute for the report of the special committee, presented two weeks before, recommending that the city lend its credit to a private corporation. This action of the Chamber seems to have met with very general approval, and Mr. R. T. Wilson, who had proposed to undertake the construction of an underground railroad in Broadway, provided the city would lend its credit, has come out in favor of Mr. Hewitt's plan. The serious objection to Mr. Wilson's plan was that an amendment to the State Constitution would be necessary before the city could aid the enterprise, necessitating long delay, while if the city builds the road directly the constitutional restriction is no obstacle, the conditions being the same as in the case of the Brooklyn Bridge or of an ordinary street or highway. This is substantially the same idea that Mr. Hewitt presented in 1888. He would have the city issue bonds at a low rate of interest and contract with a private corporation to build the road and take the proceeds of the bonds in payment. The same corporation would be required to take the contract for operating the road for a term of years, and it would, therefore, have a powerful motive to build the road honestly, so as to keep the cost as low as possible; and the rental, above the amount necessary to pay the interest on the bonds, would be put into a sinking fund with which the city would eventually pay off the principal. In order to carry out this plan it will be necessary for the legislature to amend the law of 1891, under which the Rapid Transit Commission acts.

There are certain reductions of working expenses which are perfectly legitimate, and yet which amount to paying current expenses out of capital. When traffic is light and a railroad with 5,000 cars has use for only 4,000, a thousand must stand on the sidings. Assuming that all originally are in first-rate condition, when a car requires repairs which will cost $50 what shall be done? If there is no prospect that the whole stock of cars will be required for months, the only reasonable thing to do is to take a sound car from the sidings and leave the damaged car in its place. In that way the expenses for the time are reduced $50, but the value of the property represented by the capital is also reduced $50. If the car is not needed for six months, the company saves the interest on $50 for that time. Now this can go on for a long time: a car may be utterly wrecked, but it would be folly to replace it when it will not be needed. In these days of uniform construction and interchangeable parts, a truck or axle with its wheels, and various parts of cars, and to some extent of locomotives, maybe taken from the idle stock on sidings to make repairs—all of which is paying maintenance expenses out of capital; but it permits the keeping of the rolling stock actually used in perfect condition, and is entirely legitimate; and in this way if traffic remains light a long time an enormous reduction in the *expenditure* for maintenance may be made with comparatively little reduction in maintenance *expenses*. Every dollar so saved is a reduction of a dollar in the aggregate value of the property—is a reduction of the amount of the property—and ought to be plainly stated in all reports when the process extends over a considerable period, as it did on many railroads after 1873. There is an actual saving in the interest on cost of repairs not needed at the time; but there is an apparent saving much greater which may be a very great relief to a hard pressed company, enabling it to live on capital for which it has no immediate need. The wisdom of such a policy at any given time, of course, depends upon the length of time that traffic is to continue light and the equipment in need of repairs will not be needed. A sudden revival of business when all your spare cars must go into the shops before they can be used leaves the chief advantage of the revival to your rivals for a considerable time when the traffic is worth most; for it is when traffic presses that rates are best maintained. But in a great many cases the companies do not deliberately choose this policy; it is forced upon them. And this is why when business revives after prolonged depression we usually see that those companies which have had most trouble to make both ends meet for some time gain less than their prosperous rivals, have their repair shops running night and day, and give orders for large additions to their rolling stock to be delivered at the earliest possible moment. Their managers may have foreseen the revival as clearly as their rivals, but until it actually came they had not the means nor the credit necessary to provide for it.

Nature seems to have taken a hand in the matter of maintaining a 25 cent grain rate from Chicago to New York. The ice in the Straits of Mackinaw is said to be very rotten already, with a prospect of going out when the winds blow right. It will not do to count on the continuance of the summery weather of these first days of March, but it is not probable that the ice will again become as thick as it has been, and with a prospect of open lake navigation by April 1, which has happened occasionally, the railroads are not likely to collect 15 cents a bushel on much more wheat. The difference between Chicago and New York prices indicates that they are not getting that now, nor even 12 cents. An early opening of the lakes and canals, though in some respects unfavorable to the railroads between the upper lake ports and the seaboard, is probably advantageous for the railroad system as a whole, and gives a considerable stimulus to business. In some of the very best years for railroad earnings—1880 for instance—navigation opened very early; and early springs are generally favorable to crops. As, however, this may reach our readers when the thermometer is below zero, though it is written by an open window, we shall not enlarge further on their advantages.

Those who are interested in improving the efficiency of locomotive operation will find in this issue extracts from an interesting paper on "Steam Distribution for High Speed Locomotives," by Mr. C. H. Quereau, Engineer of Tests on the Chicago, Burlington & Quincy. Mr. Quereau gives more facts about the actual distribution of steam in locomotive cylinders than have ever been gathered together before. His conclusions are practical. Many of them, in fact, are self-evident, while others will require more data to give substantial proof of what is said. It will be evident to those who read this article that the members of the Western Railway Club are producing a valuable collection of papers which will be of practical value to designers of engines and cars. We hope to further discuss Mr. Quereau's paper in a subsequent issue.

The use of dead blocks with vertical plane couplers is being discussed a good deal lately. Opinion as to the real practical value of dead blocks with the vertical plane coupler on freight cars is far from being settled, although a discussion has been in progress for a long time. The present activity is because reports of service are beginning to come in. Those who have tried dead blocks with the vertical plane coupler find from their records that there is a reduced breakage of such couplers and this is claimed to prove conclusively that dead blocks are a protection to couplers. The points brought out by discussion so fa are somewhat as follows: Dead blocks prevent severe blows on couplers and draft gear, in coupling, when the cars are brought together with one or both knuckles open; but when both knuckles are closed, the dead blocks are not a protection to the knuckles, couplers or draft rigging. In this connection, however, the advocates of the use of dead blocks argue, with force, that cars are seldom brought together with the knuckles closed, and therefore during the principal part of service the dead blocks are a protection. While a train is running all the shocks due to irregular handling of the locomotive and brakes are taken by the dead blocks, and the couplers are thoroughly protected. It has been claimed that dead blocks interfere with the coupling of cars on sharp curves, and this is true under extreme conditions, but the advocates of the dead blocks claim that this very seldom occurs and that it is a simple matter to use a link in such cases to pull the cars out where they can be coupled. There are but few freight yards where the vertical plane coupler will not couple when dead blocks are used. Under conditions generally obtaining it would appear that the dead blocks are a protection not only to the couplers but to the draft rigging as well. Some ask, "Is it a fact that the vertical plane coupler needs any protection?" The advocates of dead blocks reply to this that the more they are protected the less they will break, and whether the couplers need protection or not it is clear that the draft rigging needs it and the dead blocks under average conditions do give protection. It is, of course, desirable to get rid of dead blocks if possible, as they are dangerous to trainmen when coupling with links, and links will have to be used for some time yet. The subject has many sides, and is both humanitarian and economic, and the question is not to be settled by an off-hand decision. Mr. William Forsyth, Mechanical Engineer of the Chicago, Burlington & Quincy, in a paper before the Western Railway Club in 1892, said:

> "Buffer blocks at each side of a link coupler, though not a desirable thing for the safety of trainmen, are a great protection to the coupler. The advantage of buffers is so great that they are largely used with link couplers, notwithstanding the danger to the men. . . . I have for several years advocated the use of spring buffers in connection with the M. C. B. coupler, but a practical device for the purpose has not yet been introduced, and it will be necessary to make a start in this direction and demonstrate their real economy notwithstanding the extra cost. Couplers should be arranged so that when unlocked the knuckle will always stand open. Several coupler companies now claim to accomplish this.

The Distribution of Weight on Driving Wheels.

A subject on which very little has been written is brought up by the following query sent in by a Master Mechanic:

> Do you know of any literature on the distribution and equalization of weight on the driving wheels of different types of locomotives? What I want to get at is the best relative locations of centers of the wheels and trucks to get as nearly as possible an even distribution of weight on the drivers. If you know of any writing on this subject you will do me a favor by a suggestion.
> F. A. H.

There are a few practically fixed customs which simplify the problem of distribution considerably. For example, it is customary to place the center of the truck directly under the center of the cylinders in order to give clearance between the truck wheels and the cylinder casings. This fixes the position of the truck with reference to the other parts on all locomotives of the ordinary type having four-wheel trucks. With locomotives having a two-wheel truck the wheels are placed in front of the cylinder and as far back as possible, the limits being that the wheels must clear the front rails of the frames and the cylinder head casings.

The weight on the truck will depend then upon the location of the driving wheels and the equalizer fulcrums of the driving springs; that is, for engines having four-wheel trucks without equalizers between the truck and the front drivers. Where there is a truck equalizer reaching back to the cross equalizer of the front driving spring, as in mogul and consolidation engines, the weight upon the truck will depend upon the position of the front equalizer fulcrum.

To determine the distribution of weight on the different wheels and the truck of a proposed design of locomotive, we must first find the longitudinal position of the center of gravity of that part of the locomotive which rests on the driving springs and the truck, omitting the parts below the springs. The distance of the center of gravity from the track need not be determined. It will generally be found, for ordinary types of locomotives, that the center of gravity is just in front of the firebox.

Having determined the position of the vertical line passing through the center of gravity, the next step is to find the resultant of the equalizing systems. To do this lay out the positions of the equalizer fulcrums and the points where the springs are attached to the frames by hangers. Generally locomotives are supported on one actual point, the truck center, and on two *resultant* points, viz., the resultants of the equalizing systems on each side of the engine. In the case

of a common eight-wheel engine, the center of the truck is one point of support and the centers of the fulcrums of the equalizers, one on each side of the engine, are the other two points of support, but this is only true when the fulcrums are placed in the centers of the equalizers and the springs are placed central over the driving boxes.

Ten-wheel locomotives generally have all of the springs on each side of the engine equalized together. Where this is not done the distribution of weight will vary with the unevenness of the track and will depend also upon the stiffness of the springs. In European locomotives, where no equalizers are used, the distribution of the weight depends almost entirely upon the stiffness of the springs, and for this reason the springs are provided with a screw adjustment, which can be varied from time to time as the springs take a permanent set. The method of determining the distribution of weight with given stiffness of springs when there are no equalizers can be learned from what follows about engines having equalizers.

To find the resultant of an equalizer system, assume that one of the points of attachment of the supports of the frame carries 1 lb. of weight of the engine above the springs, then the amount carried by the other points of support will depend upon the length of the equalizer arms. If the arms are equal and the springs are placed centrally, then each fulcrum of the equalizers will carry 2 lbs., and each attachment of the ends of the springs to the frames will carry 1 lb.

In the case of a 10-wheel engine having equalizers and the springs placed central and the wheels on each side all equalized together, the engine will be supported on each side at four points as follows: The back driving spring hanger, where attached to the frame, carrying, say, 1 lb.: the fulcrum of the back equalizer, carrying 2 lbs.; the fulcrum of the front equalizer, carrying 2 lbs.; and the front driving spring hanger, where attached to the frame, carrying 1 lb. The weights here given are simply proportional, and are determined by simple inspection from the equalizer system. If the arms are unequal, then these "ratio weights" must be calculated in the well-known way of calculating leverages. To determine the resultant point of support, assume a line somewhere near the center of the equalizer system, and find the distance of each point of support from this line and multiply each distance by the "ratio weight," which each point carries. The sum of these products or moments on each side of the line are equal when the line assumed passes through the resultant center of the equalizer system. If there is a difference in these sums subtract one from the other and divide by the sum of the assumed weights, and the quotient will be the distance which the assumed line must be moved to pass through the resultant point of the equalizer system. To check the work, find if the sum of the products of the "ratio weights" and the distances of supporting points from the new center lines are equal.

Having now the proportion of the three points of support, viz., the resultants of the two equalizer systems, one on each side of the locomotive, and the center of the truck, the proportion of the total weight of the locomotive above the driving springs that will be carried by each of the two resultant points of support and the truck are readily found by a plan similar to that just outlined, as follows:

The equalizer systems are usually made the same on both sides of the engine, hence the resultant points of the systems are opposite each other, and this is the condition of design on which this method of analysis is based. Divide the total weight above the driving springs by the distance between the resultant center of the equalizer systems and the center of the truck bearing, and multiply the quotient by the distance between the center of gravity of the engine and the truck center; this will give the weight carried by the resultant center of the equalizer system. One half of this is carried on each side. Multiply the same quotient by the distance between the resultant center and the center of gravity, and the product will be the weight carried by the truck.

One-half of the weight found on the resultant center is to be distributed by the equalizer system on each side. The weight carried by the different points will be in the same ratio as the "ratio weights" which have been assumed in what preceded. To find the amount carried at each point of support, divide one-half of the resultant weight on both equalizer systems by the sum of the "ratio weights." Multiply the quotient by each ratio weight and the product will be the weight carried by that point.

To the weights found above must be added the weights of the driving wheels and all parts below the driving springs. Given the weight on the supporting points, and the weight carried by the driving springs is readily ascertained by the well known principles of levers. In general the driving springs will carry the same weight as the equalizer fulcrums, that is, when the arms of the equalizers and springs are equal. To the weights carried by the driving springs must be added the weights of the driving spring and all parts below the springs in order to find the weight of each wheel on the track.

With moguls and consolidations, where there is an equalizer between the two-wheel front truck and the front drivers, the process is exactly the same as outlined in the foregoing, only the resultant of the front system of equalizers must be determined just in the same way as for the rear system. And in such cases the resultant of the front system must be taken instead of the center of the truck, as in the foregoing.

The specific question of our correspondent is how to locate the wheels and trucks to get as nearly as possible an even distribution of weight on the drivers. The specific reply to this is that within reasonable limits the centers of the driving wheels may have any position whatsoever with reference to each other, and an even distribution of weight can be had by placing the equalizers and springs central. The only difference in the weights of the different wheels on the track will then be in the weights of the parts below the spring. But if our correspondent takes a given locomotive constructed in this way, especially a new one, and determines the weights on each pair of drivers by the ordinary track scales, he may find a wide difference in the weights, which will appear to show an error in this reasoning. But the error will be only an apparent one, as the difference in weight under such conditions, where the scales are accurate, is the result of the friction of the driving boxes in the frame and the friction of the equalizers. Before an engine can be weighed with accuracy, the shoes and wedges must be loosened and the fulcrums oiled so as to give as much freedom as possible and always, before weighing, locomotives should be examined to see if the boiler is not too high, front or back.

The Pennsylvania Railroad Report.

The report of the directors of the Pennsylvania Railroad Company, which appears at this time of the year, has always been a somewhat brief summary of the results on the great complex of railroads worked and controlled by the company, the particulars of which are given later, partly in the full report of this company, and partly in those of companies controlled. This year the report is briefer than heretofore, giving no details for the three grand divisions east of Pittsburgh and Erie, but only their aggregate earnings and expenses, which were reported a month ago. The additional figures are chiefly financial. We have been told before that on the lines east of Pittsburgh and Erie there was a decrease of $2,466,621 in gross and of $643,277 in net earnings. Now the whole income is shown to have been:

	1893.	1892.
Net earnings	$19,379,206	$20,022,483
Income from investments, rental of rolling stock, etc	6,036,941	6,042,991
Total income	$25,416,147	$26,065,474
Interest, rentals and other prior charges	15,299,712	$15,859,564
Balance of income	$10,116,435	$10,205,910

The enormous investments of this company in the securities of other railroads make its net earnings an unusually imperfect index to its available income. We see above that the income from these investments was nearly one-third of the net earnings of the railroads which this company works, and were but $6,050, or one-tenth of one per cent., less than in 1892. Some of the rentals vary with the earnings of the roads leased, and there was a decrease of $559,852 in the prior charges, which was so near the amount of the decrease in net earnings that the balance of income available was but $89,475 less than in 1892, out of a total of more than 10 millions. This income was equal to $7.83 per $100 of stock. The dividends amounted to $5, of which $641,610 was paid into sinking and trust funds and for guaranteed interest (the latter becoming an asset), $2,163,210 was invested in improvements not charged to capital (against $1,263,137 in 1892), leaving a surplus of $911,108, against $1,222,357 in 1892.

The earnings and expenses of the lines *west* of Pittsburgh and Erie which the Pennsylvania controls are given for the first time in this report, the monthly reports of earnings giving only the variations in the profit or loss to the Pennsylvania Railroad from these lines. The figures are:

Lines of Penn. Co.:	1893.	1892.	Inc. or Dec.
Gross earn	$21,681,237	$22,506,656 D.	$825,419
Expenses	13,750,576	14,454,302 D.	703,726
Net earn	$7,930,661	$8,052,354 D.	$121,693
Rents, interest, etc	6,880,185	6,822,380 I.	57,805
Profit	$1,050,476	$1,229,974 D.	$179,498

Pitts., Cin., Chic. & St. L.:	1893.	1892.	Inc. or Dec.
Gross earn	$18,419,058	$18,923,944 D.	$504,886
Expenses	13,885,732	14,205,416 D.	319,884
Net earn	$4,533,326	$4,718,528 D.	$185,002
Rentals, interest, etc	3,658,990	3,576,007 I.	82,983
Profit	$874,536	$1,142,521 D.	$267,985

The profit on these two systems fell from $2,616,621 in 1891 to $2,372,495 in 1892, and $1,925,012 last year. There are several other railroads west of Pittsburgh on account of which the Pennsylvania Railroad Company has assumed obligations, the chief of which are the Vandalia Line and the Grand Rapids & Indiana. These had in the aggregate:

	1893.	1892.	Inc. or dec.
Gross earnings	$5,442,498	$5,938,983 Dec.	$496,485
Expenses	4,354,743	4,240,821 Inc.	113,922
Net earnings	$1,087,755	$1,698 162 Dec.	$610,407
Rental, interest, etc	1,157,618	1,669,472 Dec.	511,854
Profit or loss (loss	$69,863	(prof.) $28,690 Dec.	$98 553

These lines had a decrease of 8¼ per cent. in gross earnings, against 2⅞ on the Pittsburgh, Cincinnati Chicago & St. Louis, and 3⅜ on the "Pennsylvania Company's" lines; but they are chiefly distinguished by an *increase* in working expenses, in the face of a considerable decrease on the other lines, which causes a decrease of no less than 36 per cent. in their net earnings.

The Pennsylvania Railroad Company was responsible for $49,902 of the loss of these lines, having received $20,493 of their profit the year before—insignificant amounts for a company with so great an income. The net direct profit of the company from all the lines west of Pittsburgh and Erie, has been:

1889.	1890.	1891.	1892.	1893.
$1,013,865	$1,756,932	$2,662,970	$2,392,988	$1,875,110

In the five years previous to 1889 these lines made profits only in 1886 and 1887, there being an average yearly loss for the five years amounting to $95,602. It would be a great mistake, however, to measure the advantage of these lines by the direct profit from their working. The profit which the Pennsylvania Railroad makes on the traffic exchanged with them must be much greater than the above, and a very large part of this traffic is secured to it only by its control of these lines.

The general balance sheet shows an aggregate increase in assets amounting to $6,955,756. Cost of road increased nearly $3,000,000, and of equipment as much; and the real estate account is increased nearly $2,400,000. For additional securities $5,100,000 was spent, and sinking funds and smaller items brought up the aggregate of the expenditure for assets to $14,284,759; while the construction account of the United Railroads of New Jersey was *reduced* $736,000; other investments were reduced more than a million; the advances to other companies $3,660,000 (probably securities of these companies were received for them), and other reductions made the amount charged off $7,329,003.

In the liabilities, small amounts of bonds were paid off, while the issue of stock was increased by $2,496,550, of bonds and mortgages by $5,109,913. Current liabilities were reduced more than $2,100,000 for pay, rolls, vouchers and traffic balances, and increased $2,372,410 for balances other than for traffic due other railroads. The balance to credit of profit and loss increased only $16,292, against $2,127,026 in 1892, which is more than accounted for by the stock dividend, which was paid out of this account.

The company's investments in the securities of other corporations now represent an expenditure of $118,686,408. Last year they yielded an increase of $4,955,037, which is more than the interest on the company's own funded debt, and more than 4 per cent. on their cost.

The gross and net earnings and working expenses of all the railroads owned, leased or controlled by the Pennsylvania Railroad Company, including now about 8,800 miles of railroad, have been:

Year.	Gross earn.	Expenses.	Net earn.
1893	$135,059,788	$95,491,559	$39,568,229
1892	138,974,521	98,352,083	40,622,438
1891	134,254,613	91,819,660	42,434,953
1890	133,521,623	92,003,365	41,518.258
1889	122,917,337	83,811,128	39,106,209
1888	116,509,592	80,737,355	35,771,957

The mileage of this system has increased from 7,612 in 1888 and 7,844 in 1889 to about 8,800 miles at this time. Their gross earnings have not varied greatly for the last four years, but the expenses have changed more, and the net earnings last year were the smallest since 1889, when there was nearly 1,000 miles less road.

These are very large figures. The gross earnings in 1892 were 11.9 per cent. and the net earnings 10.4 of the aggregate gross and net earnings of the 162,397 miles of railroad reporting to the Interstate Commission for the year ending June 30, 1892. It is therefore a very substantial part of the whole railroad

system of the country which we have here reported 64 days after the close of the year.

Some further facts given in the report are printed on the last page of this paper.

The reports of the 12 principal English railroads for the last half-year show that in the aggregate their gross earnings for the six months were 5.6 per cent. less in 1893 than in 1892, and their net earnings 11.6 per cent. less. This is an extraordinary falling off for railroads in England, where the fluctuations in business are usually very much less than here. The greatest of the English companies, the London & Northwestern, lost 6½ per cent. in gross and 12 per cent. in net earnings, the latter decrease amounting to about $1,600,000. But smaller companies were greater sufferers, the Great Northern losing 15 per cent. in net earnings and the Manchester, Sheffield & Lincolnshire 46 per cent., which latter reminds us of the experience of the Chicago, Burlington & Quincy during the strike year. The Midland, which with the Great Western ranks next after the Northwestern, suffered a decrease of 14.7 per cent. in gross and of 26½ per cent. in net earnings, the latter amounting to about $2,900,000. Only two of the 12 railroads had any gain in gross earnings, and only one, the Northeastern, a gain in net earnings. Fortunately for them the English railroad companies carry more ballast than ours, and this great decline in income results in nothing more than a reduction in dividends; but this has been serious, the whole amount divided by the 12 companies for the half-year falling from $31,458,980 for 1892 to $23,030,274 in 1893, which means a serious reduction of income to a great many people. Owing to their relatively steady returns railroad shares are held in England by people of moderate means who depend upon their dividends for an income much more than in this country. The chief cause of this disastrous result is the great strike of the coal miners, which has not only lessened traffic but increased expenses by raising the price of coal. With a decrease of $9,058,380 in gross earnings of the 12 companies, working expenses were reduced only $500,848. The Scotch railroads, and the one prosperous English company carrying coal from mines where there is no strike, have profited by the misfortunes of their southern neighbors. The lines in the south of England, where there is no coal, have suffered only from the general shock to business, and have comparatively trifling losses in receipts, but have increased expenses, as has also the Sheffield company, with its decline of 21 per cent. in gross and 46 per cent. in net earnings. If misery loves company, our railroad investors thus have abundant opportunity to exercise their affection across the ocean as well as at home.

While we are searching for the very low price of wheat from which large parts of this country and many of our railroads are suffering, we shall do well to study the Russian production and exports. The Russian Department of Agriculture has recently published corrected estimates of the grain crops of the six years ending with 1892, together with the exports of those years, the average home consumption of wheat and rye per individual, and its provisional estimates of the crops of 1893. We have reduced the figures to our bushels, and below give the crops and exports in *millions* of bushels:

Crops:	1887.	1888.	1889.	1890.	1891.	1892.	1893.
Wheat	234.0	264.2	112 1	159 6	120.7	199.1	251.9
Rye	636.7	615 5	432.6	544.8	371.2	492.5	617.4
Oats	424.0	516 2	371.4	434.5	311.4	343.6	595.0
Barley	269.2	207.0	143.6	227.1	189.2	252.5	221 5
Exports:							
Wheat	124.7	126.3	97 9	102.6	35.8	83.8	....
Rye	59.5	68.7	49 1	64 9	0.8	14.6	....
Oats	98.4	85.9	63.3	63.5	24.1	30.5	....
Barley	52.8	57.5	43.0	38.7	22.2	51.4	....

The estimates of home consumption indicate it to have been an average of 56 lbs. of wheat and 261 lbs. of rye per individual yearly. Thus the Russian's chief bread is rye, and the country, in years of average production, can spare the larger part of its wheat crop, as it has done repeatedly. Of the fair crops of 1892, out of which the stocks exhausted in 1891 had to be made good, 83.8 million bushels of wheat and 14.6 of rye were exported. Now the provisional estimates give 53 millions more of wheat and 125 millions more of rye in 1893 than in 1892, which indicates that Russia can export 136 million bushels of wheat and 139 millions of rye this crop-year if it can find a market for it. Germany and Scandinavia, the great rye-consuming countries, are just across its border, and it is probable that the Russian surplus of rye has as much to do with reducing the price of wheat as the surplus wheat crops of any country whatever.

The Pennsylvania Railroad Company's gross earnings on its lines east of Pittsburgh and Erie were $763,416 (15½ per cent.) less in January last than in the corresponding month last year, 17 per cent. less than in 1892, and $1,152,645 (21.7 per cent.) less than in 1891, having decreased every year since. The great reduction since last year was more than made good, however, by a monstrous reduction of $877,616 (19.8 per cent.) in working expenses—a reduction which would be painful to contemplate but for the fact that working expenses were extraordinarily great last year. Compared with 1892 the reduction in working expenses is only $400,000, or 10 per cent, which is more reasonable. The result is that the net earnings in January were $614,506 this year, against $500,396 last—an increase of $114,110, or 22¾ per cent, which seems very satisfactory until we compare with January net earnings in previous years, which have been:

1887.	1888.	1889.	1890.	1891.	1892.
$1,214,351	$1,005,920	$1,080,796	$1,306,046	$1,447.219	$1.074,552

Thus in spite of the gain over last year, the $614,506 of net earnings this year were 44 per cent. less than in 1892, and not half as great as in the two previous years, and 45 per cent. less the average of the above six years. It is much more important that the working expenses should not be too much reduced than that the net earnings should be maintained. Actually the expenses since 1888 ranged between $3,447,950 and $3,945,189 until last year, averaging $3,773,665, from which the decrease this year is only $228,341, or 6 per cent.—an entirely reasonable reduction. The Pennsylvania's lines west of Pittsburgh and Erie had a decrease of only $10,912 in net earnings, gross earnings and expenses both having decreased more than $400,000.

Complaint has been made that working expenses have not been sufficiently reduced on the New York, Lake Erie & Western Railroad, because the reduction last January was not, as on some other railroads, equal to the reduction in earnings. The January expenses of the Erie were 13 per cent. less than last year and 17 per cent. less than in 1892. As this company last year was probably trying to escape from the embarassments that overtook it a few months later, it is probable that the expenses then were limited to the strictly necessary, and a decrease of more than one-eighth from that seems all that is reasonable. From temptation to that kind of economy which saves a dollar now at the expense of a dollar and a half a year or two later, the Erie is delivered by its receivership. That kind of economy is doubtless practiced now by more than one company, and we shall not say that it is not sometimes justified, lest a worse evil befall. But it is a matter for congratulation, and not for condolence, when a railroad in these days does *not* reduce its expenses very largely.

A substantial reward of gratitude and appreciation from many—including all classes of railroad officers and employees and students—awaits the philanthropist who will make a catalogue, with brief descriptions, of books on the different departments of railroading. Such a list should contain publishers' names, and should say whether the book is readily obtainable, or "rare," or "out of print." It would have a value if limited to the English language and to books alone; an added value if it included pamphlets; and the French and German publications should, if possible, be included. Messrs. G. P. Putman's Sons, of 29 West Twenty-third street, New York, have prepared a list of their own publications on this subject, most of them standard and of great worth. The difficulty is that no one publisher is financially justified in preparing a single-subject catalogue, which will include the publications of all others. There is a money reward, but probably an inadequate one. The work remains, therefore, for the philanthropist, for the book-lover. Judging from our own correspondence and the frequent requests we receive, the demand is great and the satisfaction to be afforded immeasurable. The reward is honor in one's own country.

Bananas are flying about in a way to astonish the natives, throughout some 500,000 square miles of the Mississippi Valley. It appears that Mobile and Galveston merchants are trying to get the Chicago banana trade away from New Orleans, and at the rate the competition has begun, the fruit will soon be sent by telegraph. Our readers will recall the report, printed in these columns last week, that the Illinois Central had taken a train of 15 cars from New Orleans to Chicago, 912 miles, in less than 36 hours, or at the rate of 25½ miles an hour; but now the Atchison, Topeka & Santa Fe comes forward with a record that makes us hide our heads with shame that we ever printed the other. A train leaving Galveston on the evening of Feb. 28 was run through to Chicago, 1,410 miles, in 42¾ hours, more than 10 hours quicker than the best previous run over that line, and equal to 32.98 miles an hour for the whole distance, including stops. The 551 miles from Galveston to Oklahoma City was run at an average speed of 29.4 miles an hour, and on the prairies of Indian Territory, where there was no other train within 500 miles, more or less, 13 miles was traversed in 13 minutes. We have seen no statement of the number of cars in this train.

An order has been promulgated on the Erie road throughout the lines, including the Chicago & Erie, to suspend freight business, except perishable goods and livestock, for 24 hours on Sunday. This order seems to have a more practical air about it than those of a similar nature issued by the Pennsylvania and the Vanderbilt lines three or four years ago, which soon came to be more honored in the breach than in the observance. In a time of dull traffic like the present, however, it is easy for all of us to be virtuous. The curtailment of Sunday freight traffic has lately received attention in Belgium and in Prussia, in both of which countries the roads are operated by the state. In Belgium only 8 per cent. of the freight trains (this evidently means freight schedules) are in operation on Sunday. In Prussia a special commission has investigated every freight run and made an elaborate report. This report recommends that twice as many men be let off on Sunday as at present, but holds that when freight traffic is heavy the Sunday closing idea must take a back seat, so to speak.

The latest dispatches from the West indicate that an attempt is being made by the presidents of the other lines to bring about a compromise between the Southern Pacific and the Atchison. It is hoped that these efforts will prevail. The conditions at present are such that the results of a passenger rate war in this territory must soon do great harm to others than the lines directly interested. It is said that the Atchison officers think it a good opportunity, while they are in receivers' hands, to force a settlement of some long-standing grievances between itself and the Southern Pacific, now that the latter has taken the initiative, and that the Southern Pacific is equally anxious to use the present depressed situation as a lever to acquire for itself some concessions from the Atchison, relying on its local fares from the influx of tourists and colonists to make up for losses on the overland haul. With two such monsters fighting, some of the other interests between the Mississippi River and the Rocky Mountains will probably be in a very helpless situation.

NEW PUBLICATIONS.

The Inventions, Researches and Writings of Nikola Tesla. With Special Reference to His Work in Polyphase Currents and High Potential Lighting. By Thomas Commerford Martin, editor of *The Electrical Engineer*, Past-President American Institute Electrical Engineers. New York: Published by *The Electrical Engineer*. 1894. 403 pages; 330 illustrations and new portrait. Price $4.

Mr. Tesla has, within a few years, become widely known as one of the foremost experimenters in special branches of electrical research, though the scope of his work and the extent of his investigations have been but little understood except by electrical experts. Mr. Martin's book does not cover all the work of Mr. Tesla, but most of it. The volume is one of absorbing interest to those watching the general advance of natural philosophy and to those directly interested in the development of alternating current apparatus.

Mr. Tesla was born in Servia in 1857, and was educated for the church, in which his forefathers were clergymen, but a decided bent towards technical studies led him to the Polytechnic School at Gratz to study for a professorship of mathematics and physics. Later an engineering course was entered upon. After graduation some time was spent in telephone and telegraph work in Hungary, and later Mr. Tesla went to Paris in the employ of a large electric lighting company, and thereafter came to America.

The record of Mr. Tesla's researches as shown in this volume is divided into three parts. The first deal with his work in polyphase currents, showing the varied forms of motors devised by him and the means by which they are made to work satisfactorily on alternating currents. He had seen, while in school at Gratz, the disadvantages of the direct currents for power transmission, which requires commutators both at generator and motor, those at the generator converting the alternating current set up in the coils of the machines to a direct current, and those at the motor changing the current back from direct to alternating. The problem of doing away with the commutators had greatly interested him and was finally solved by the construction of a motor having two or more groups of magnetic poles with corresponding groups of coils in the armature. This machine generated two or more currents of different phase and effected the necessary shifting of the poles and the consequent rotation of the moving part of the machine. The variations and improvements in the design and operation of this polyphase alternating current rotating field motor, as it is called, are fully set forth. The second section deals with his experiments with currents of high potential and high frequency of alternation and includes reprints of his lectures delivered in Paris, London, New York and elsewhere. Some of the more striking of the experiments enumerated are: the lighting up of an electric lamp without the usual connections, and, coupled with it, the suggestion of a system in which an entire room should be made an electro-static field of such intensity that a vacuum tube of any size, not connected with any other object, would glow brilliantly whenever brought into the field; also the passage through the human body of a current of 200,000 volts, with 1,000,000 alternations a second. In this experiment streams of flame burst from the body, though without doing the slightest harm. Mr. Tesla proposes the use in the same way of a current of 3,000,000 volts. With low frequency a current of very much less intensity would instantly prove fatal. The most painful effect would be from an alternating current of low frequency, and the most injurious and destructive the continuous or direct current.

The third section describes a variety of Mr. Tesla's inventions in other branches of electrical work, including dynamos, motors, arc lamps and unipolar machines, and the fourth section some of his earliest motors and his new mechanical and electrical oscillators. With the mechanical oscillator he obtains a high number of vibrations per second at an absolute constant rate, the length of stroke varying according to the pressure of steam or air supplied, and it performs the functions of a steam engine in the generation of electric currents.

It may be said that in some cases Mr. Tesla has traversed ground hitherto explored by others, yet not

without discovering additional facts and making suggestions the value of which can only be ascertained by further experiment. His contributions to scientific knowledge are most important, but just how valuable they are, or what influence they may have upon the future development of electric lighting and power transmission, it is too early to predict.

The Mechanics of Hoisting Machinery. By Dr. Julius Weisbach and Prof. Gustav Hermann. An authorized translation from the second German edition by Karl P. Dahlstrom, late Instructor in Mechanical Engineering at Lehigh University. McMillan & Co., New York and London, 1893; 329 pages, 177 illustrations. Price $3.75.

A large part of Weisbach's work on Engineering Mechanics is already familiar to English-speaking engineers and designers, through the translations of Coxe, DuBois and Klein. No translation of the present section has ever before appeared, though widely recognized as a standard work upon the subject treated. This volume covers quite thoroughly the subject of hoisting machinery, including jacks and levers, tackle, windlasses, winches, hydraulic and pneumatic hoists, cranes and shears, excavators, dredges, pile drivers and kindred topics. To one desiring a review of current practice in this field the volume may be a disappointment, the illustrations being somewhat elementary in style and representing appliances of rather a primitive form, as is usually the case in works of this class. Each subject is carefully and comprehensively treated, and fundamental formulas are given for the guidance of those wishing to determine the efficiency of hoisting machinery. Tables of efficiencies are given for various proportions of hoisting mechanism. The chapters on hoisting machinery for mines and hydraulic and pneumatic hoists seem especially complete. Sixteen pages are given in the latter chapter to the mathematical consideration of the action of the accumulator.

The work, as a whole, constitutes a valuable addition to permanent technical literature, and will be appreciated especially by those in charge of the engineering departments of educational institutions.

Engineering Education.—The Proceedings of the World's Engineering Congress. Published by the Society for the Promotion of Engineering Education, as Volume I of their proceedings, by the committee, DeVolson Wood, I. O. Baker and J. B. Johnson. 1894. Pages 342. Price $2.50.

This book is a publication of the papers and discussions presented at the World's Congress, July 31 to Aug. 5, 1893, at Chicago. It comprises the following papers with the discussions of each: The Ideal Engineering Education, Prof. William H. Burr; Requirements in Mathematics for Engineering Education, Prof. A. N. Talbot; Present Favorable and Unfavorable Tendencies in Engineering Education, Prof. P. C. Ricketts; Comparison Between American and European Methods in Engineering Education, Prof. Geo. F. Swain; The Growth of American Mining Schools and Their Relation to the Mining Industry, Prof. Samuel B. Christy; The Equipment of Engineering Schools," Prof. Dr. R. H. Thurston; The Hydraulic Laboratory of the Massachusetts Institute of Technology, Prof. Dwight Porter; The Teaching of Graphical Methods in Engineering Colleges and Schools, Prof. H. S. Hele-Shaw; On Original Research by Students in Undergraduate Courses in Engineering, especially Civil Engineering, Prof. Chas. D. Marx; Original Research by Students, Prof. R. C. Carpenter; Field Practice and Field Equipment, Prof. Chas. D. Jamison; Training of Students in Technical Literary Work, Prof. M. Merriman; Methods of Studying Current Technical Literature, Prof. J. B. Johnson; Drawing for Engineering Students, Prof. Chas. S. Denison; Vacation Work, Prof. A. E. Burton; Graduating Theses, Prof. G. Lanza.

Annual Report of the Smithsonian Institution to July, 1891. Washington: Government Printing Office. 1893.

Like many other Government publications this volume comes to hand two years behind time. It contains the usual reports of proceedings of the Executive Committee and the Secretary. Among the subjects treated are "The Sun's Motion in Space," by A. M. Clerke; "A Southern Observatory," by A. M. Clerke; "Applications of Physics and Mathematics to Geology," by C. Chree; "Origin of the Rock-pressure of Natural Gas," by Edward Orton; "Geysers," by Walter Harvey Weed; "The General Circulation of the Atmosphere," by Werner von Siemens; "The Gulf Stream," by Alexander Agassiz; "Absolute Measurement of Hardness," by F. Auerbach; "The Flow of Solids," by William Hallock; "The Scientific Work of G. S. Ohm," by E. Lommel; "Autobiographical Sketch of J. von Liebig"; "The Corbin Game Park," by John R. Spears; "Summary of Progress in Anthropology in 1891," by O. T. Mason; "The Mounds of the Mississippi Valley," by Lucien Carr; "The Use of Flint Blades to Work Pine Wood," by G. V. Smith; "Timekeeping Among the Chinese," by D. J. Magawan. The volume contains little of immediate interest to railroad men. It is largely devoted to natural history subjects, including astronomy, geology, physical geography, botany, zoology, anthropology and forestry. The biographical sketches of G. S. Ohm and J. von Liebig will be of special interest to electricians and chemists. The paper on the flow of solids may be of interest to manufacturers who are forging iron under great pressure.

The Locomotive Engine (La Machine Locomotive), by Edouard Sauvage, Engineer in Chief of the Eastern Railroad of France: Baudry & Co., editors, Paris. The Polytechnic Library, 1894. Pages 327, 12mo. Price 5f.

This book is in the French language, but it is such a capital work that it deserves a word here. It is a practical treatise on the parts of a locomotive and their functions and the best usages of mechanics and boiler makers. It is a book which has been published especially to unite theory and practice and to bring before its readers the most important modern improvements. It will appeal to enginemen, and contains also much interesting information for Master Mechanics, Superintendents of Motive Power and even for the manufacturers of locomotives. The first chapter is given to generalities and includes dynamometry and resistances of trains, the pressure of steam, the combustion of fuel and the adhesive and tractive power of locomotives. Chapter II. treats of the steam generating parts and Chapter III. is given to the mechanism of the locomotive. These chapters are followed by one on the locomotive frame, the suspension of the working and generating parts and the wheels, a chapter on the different types of locomotives, one on the tenders, one on braking, one on the care and inspection of the locomotive, one on station service and a final chapter of conclusions. The book is profusely illustrated, and gives a large amount of information in a concise and practical form.

Transactions of the American Society of Mechanical Engineers. Vol. XIV. 1893. New York: Published by the Society. 8vo.; 1461 pages.

This volume is unusually large, including as it does papers read at the Engineering Congress in Chicago. Some of the papers that are of special interest to railroad men are the following: Tests of Driving Belts, by Samuel Webber; A Boiler Explosion, by Fred H. Daniels; Comparative Variation in Economy with Change of Load in Simple and Compound Engines, by R. C. Carpenter; Improvements in the Art of Cable Making, by Emil Guilleaume; Locomotive Operating by Total Adhesion on Curves of Small Radius, by A. Mallet; The Collection of Dust Produced in Workshops, by R. Kohnfahl; Experiences in the Operation of Rack Railways, by Albert Schneider; Tests of Locomotive at Purdue University, by W. F. M. Goss; Technical Education in the United States, by R. H. Thurston; Haulage by Horses, by Thomas H. Briggs; Compression as a Factor in Steam Engine Economy, by Frank H. Ball; Performance of Street Railway Power Plant, by Wm. A. Pike and T. W. Hugo; The Development of the Compound Locomotive, by A. Von Borries; Reports of Committee on Uniform Methods of Tests and Testing Materials, with Appendix; Report of Committee on Standard Method of Conducting Locomotive Tests.

Massachusetts Institute of Technology, Boston, 29th Catalogue, 1893-4. Cambridge: John Wilson & Sons. Pages 273.

This catalogue first gives a historical sketch of the Institute, then the usual roster of the members of the corporation, the committees, officers, etc. One hundred and fifteen pages are given to the subjects offered, the courses and the methods of instruction. This is followed by a complete register of students, including 334 special students, a total of 1,234, which, after deducting names counted twice, leaves students in attendance 1,157. There is a register of graduates, their residences and occupations, which number 1,117. The annual report of the President and Treasurer shows the growth and development of the Institute, the ages of students on entrance, women as students, graduates of other colleges, and a review of the work of the several dapartments. The Treasurer's report shows an expenditure for the year of $743,269.

Coal Statistics.—A manual giving directories of all coal mines in the United States together with statistics of production, distribution and other matters relating to the coal trade in general. Philadelphia, Adler & Ruley, 1894; 185 pages. Price 50 cents.

This little volume is 4½ × 6½ in. and contains the statistics of the coal production of all the coal producing states of the Union, of Alaska and the other territories. It also contains statistics of the distribution of coal to the different states and to the principal cities during the year 1893. A secondary but valuable feature of the book is that of the advertisements, which contain not only the names of the principal coal dealers of the country, but also of those firms who mine, handle and convey coal and who manufacture machines for doing the same.

TRADE CATALOGUES.

The Pittsburgh Reduction Co., Pittsburgh, Pa., manufacturer of aluminum ingots, castings, bars, plates, sheets, tubes, wire and all forms of structural shapes, has issued a new catalogue 4 × 6½ in., 47 pages, which contains valuable information about Aluminum. The book gives the chemical composition of the commercial aluminum sold by the company which consists of from 94 to 99.75 per cent. of aluminum and from 0.75 to 6 per cent. of silicon and iron. It gives the various physical properties of the metal and compares them with those of other metals better known to manufacturers. These properties include the specific gravity, weight, hardness, elasticity, strength, melting points, impurities, corodibility and solubility of aluminum and in addition certain special data including the expansion and shrinkage of aluminum due to heat, the specific heat, co efficient of thermal conductivity, malleability and the sonorous qualities when alloyed with silver and other metals. Considerable space is given to the explanation of the means and manner of working aluminum which will enable manufacturers to experiment with it and determine its value for particular purposes. These include the operations of welding, casting, annealing, rolling, polishing, scratch-brushing, dipping and frosting, burnishing, welding and soldering the pure metal as well as its alloys. Several pages are given to a description of the alloys of aluminum and copper, including the aluminum bronzes, aluminum brass, aluminum tin and aluminum zinc. The tensile and compressive strength and other useful data are included in these descriptions. The uses of aluminum in iron and steel and cast iron and its effect are given. The book has tables giving the comparative weights, sizes, dimensions and values of aluminum with other metals. These tables occupy one-half of the book.

The Ball Compound Locomotive Co., New York, has issued a catalogue describing and illustrating the company's two types of passenger locomotive, one an 8-wheel high speed passenger engine and the other a light suburban locomotive. These engines are of the tandem type and the designs are the work of Charles A. Ball, assisted by George B. Cornell and J. G. A. Meyer, Consulting Engineers. The catalogue is given to an explanation of the special features of the locomotives, the valve motion and to the advantages which are claimed for them. The distinctive feature of Mr. Ball's compound design is that it has two compound cylinders on either side of the locomotive, the pistons of which move in opposite directions and connect with a double crank. The compound cylinder is connected to the crank-pin after the usual manner, and the high pressure is connected to an arm keyed to this crankpin; thus making the connections 180 deg. apart and on the outside of the driving wheel. Another new feature is an intercepting and equalizing valve which converts the low-pressure cylinder into a high-pressure engine using full boiler pressure, and equalizes the pressure upon both sides of the high-pressure piston. This intercepting valve is moved automatically by the reversing lever.

TECHNICAL.

Manufacturing and Business.

The Davis Car Shade Co., of Portland, Me., has established an agency in Chicago with J. M. Denniston as representative. The office is at 911 Monadnock Building.

The Lodge & Davis Machine Tool Co., of Cincinnati, O., has received an order from the Société Anonyme Cockerill, Seraing, Belgium, for several of their machine tools.

Large shops have been built at Lenoir, Tenn., by John H. Bass, of Fort Wayne, Ind., for the manufacture of Bass cast iron wheels. The shops will employ about 300 men when running to full capacity.

Warren, Webster & Co., whose works are at Camden, N. J., report among other orders for the Webster vacuum feed water heaters and purifiers one from the Pullman Palace Car Co. for three aggregating over 5,000 H. P. to equip the works at Pullman, Ill.

The Shickshinny Tube Co., capital $40,000, was chartered at Harrisburg last week. The directors are: R. M. Tubbs, N. B. Crary, E. W. Garrison, M. H. Arnold, A. W. Stackhouse, C. W. Buckley, G. M. Beadle, E. S. Stackhouse and J. J. Richards, of Bloomsburg, Pa.

On March 5 the Lewis Foundry & Machine Co., of Pittsburgh, was chartered with a capital stock of $200,000. The company has heretofore been a limited copartnership, and the change now makes it a stock company. There is no change in the ownership of the concern.

The Troy Steel and Iron Works will resume work in its steel manufacturing department this week. The steel works have been idle since last May. Recently a large order for steel has been secured, and the Receiver, William Keenan, reports there is a good prospect of obtaining other orders.

The bridge and construction shop of the Pennsylvania Steel Co. at Steelton, Pa., is very busy on several large contracts, and enough work is on hand to insure running for three months at least. Among the contracts is one for a firm in Ohio. There are other large contracts for train sheds and bridges.

An order for Mason air brake regulators has been placed by the Belgian State Railroads with the Mason Regulator Co., 10 Central Street, Boston. The decision to use the Mason regulator on these lines has been made only after exhaustive tests. The regulator has already obtained a sale in other foreign countries, and recently a large number were shipped to Australia.

President Harrah, of the Midvale Steel Co., at the recent annual meeting at Nicetown, Philadelphia, reported that the past year had been the most prosperous in the company's history. The orders now on hand are sufficient, he said, to keep the plant running to its full capacity for the next 14 months. Charles J. Harrah, James F. Sullivan, A. H. Wintersteen, William Sellers and John Sellers, Jr., were re-elected directors.

Charles Davis, President of the Lodge & Davis Machine Co., of Cincinnati, has filed an answer to the application by William Lodge and others for a dissolution of the company on the ground that no dividends have been paid for several years. He states that the

earnings of the company during the period when dividends were suspended have been used in extensive improvements to the plant, and that the company is now in a position to resume the payment of dividends. He says that the assets are $393,000 with liabilities less than $4,000.

The contract for the new buildings of the Pittsburgh Reduction Co., at Niagara Falls, N. Y., was let last week to the Penn Bridge Co. at the price of $17,900. The prices of the various bidders were as follows: Berlin Iron Bridge Co., $24,000; Schultz Bridge & Iron Works, $21,130; Pittsburgh Bridge Co., $19,418; Pennsylvania Steel Co., $20,820; F. L. Garlinghouse, $19,705; Shiffler Bridge Co., $19,980; Buffalo Bridge & Iron Works, $21,393; Riter & Conley, $19,930 The plant at Niagara Falls will comprise three buildings, a reduction building, 85 × 195 ft.; a manipulating building, 70 × 75 ft., and a stock house, 70 × 100 ft.

The Automatic Electric Signal Co. has opened offices at 1656 Monadnock Building, Chicago, where it has on exhibition a short section of track and models of locomotives and cars equipped with its electric signaling apparatus for exhibition purposes. The officers of this new company are: W. R. Woodard, President, formerly General Superintendent of the Louisville, New Albany & Chicago Railroad; John D. Anderson, Vice-President, Nashville, Tenn.; S. F. Galloway, of Indianapolis, Secretary, and A. F. Copp, Treasurer. B. B. Seaton, the patentee of the device, is Electrician and Superintendent of Construction for the company.

New Stations and Shops.

A brick passenger station, costing $10,000, and a freight station will be erected at Kittaning, Pa., by the Allegheny Valley the coming spring.

The Boston & Albany has decided to carry out a long pending project of building new car repair shops in West Springfield, about two miles west of Springfield, which will be followed by the abandonment of the shops in the latter city, which for about 40 years were the principal shops of the company and have been a landmark for about half a century. The new shops will be built this summer on a lot near Cold Spring avenue. The main building will be of brick, 314×412 ft., one story high, with a second story at one end for the upholstering department.

The Goldie Spike Suit.

The suit of William Goldie *et al.* vs. The Diamond State Iron Company *et al.*, in the United States Circuit Court of Delaware, has been decided in favor of Mr. Goldie, and a preliminary injunction issued against the defendants, restraining them from the further manufacture of the Goldie spike or the use of the Goldie spike pointing machine, or of employing his method of pointing spikes. In his opinion the Judge says: "The distinguishing feature of the Goldie spike consists in its having a point provided with diagonal cutting edges, located in the same perpendicular plane with its rear side, and a compressing surface on its front side formed with oblique facets on the front sides of the cutting edges. The diagonal cutting edges as the spike is driven into the wood divides the fiber with a clear shearing cut, whereby is obtained a clear-cut backing or solid supporting wall to hold the spike against the crowding strain of the rail, while the oblique facets turn and compress the ends of the severed fiber outwardly toward the side grain of the timber, so that they bear with great friction on the body of the spike, which is held firmly in the die."

"Goldie's method of pointing spikes consists in swaging the point to form front and lower compressing surfaces, and then producing a sharp edge by shearing off the surplus metal obliquely across and in the direction of the length of the grain or fiber of the rolled iron. . . ."

The Court says that "the Goldie spike has met with universal public favor. It has gone into very extensive use all over the country. The uncontradicted proofs show that it is regarded by roadmasters and traffic officials generally as the best fastener for rails that has yet been produced." The Court holds that to all intents and purposes the defendants' construction of spikes is a mere duplication of the Goldie process.

Test of Submarine Boats.

The later experiments at Newport to determine the effect of the detonation of high explosives upon life in a boat near by and under water are much more favorable to the building of submarine boats than were the first ones made. The Navy Department has certain bids before them for the construction of such boats and desired data before considering the estimates. The torpedo was the same as that used in the original experiment of last fall. It consisted of 110 lbs. of gun-cotton in a mine submerged 15 ft. below the surface in about 42 ft. of water. The cigar-shaped lay torpedo boat, representing the submarine torpedo boat, was 305 ft. away, also submerged 15 ft. The explosions were very heavy, casting up conical masses of water to a height of 50 ft. Boats 250 yards away very clearly felt the shock. The submarine boat was found undisturbed, and when it had been towed to the shore it was found not to have been injured in the slightest degree. The animals that were in it were entirely unharmed.

The experiment was repeated under the same conditions, except that the explosive mass was moved up to within 200 ft. of the boat. The force of the explosion was great, but the boat again showed no effect. The first experiment, a pressure of 80 lbs. to the square inch, was exerted upon the boat. The pressure of the second experiment was fully 100 lbs.

Another test was with the mine of gun cotton, 100 ft. from the submerged boat, the theoretical pressure resulting from the explosion being 387 lbs. to a square inch. The boat was uninjured, and the six animals within were not affected by the shock. This test was followed by the explosion of the gun cotton at only 80 ft. from the submerged boat. The pressure then exerted, according to General Abbott's formula, was 528 lbs. to a square inch, and this time the end sections of the torpedo boat were depressed. The indentation being greater on the forward end. All the animals were in good condition.

The result demonstrated that a heavy explosion within 80 ft. or near enough to a submarine torpedo boat to depress its sides would have no effect upon the lives of men within it. The pressures are greatly in excess of that required by the government submarine torpedo boat specifications.

A Substitute for Linseed Oil.

The *Engineer* gives the following patented method for preparing a composition oil possessing the qualities of linseed oil, as a vehicle for paint. The composition consists of crude petroleum, one gallon; yellow beeswax ¼ lb. to ½ lb.; powdered resin, ⅛ lb.; zinc sulphate, ⅛ lb. to ¼ lb.; lead acetate, ⅛ lb. to ¼ lb.; rubber, ½ oz to 1 oz.; linseed oil, ½ pint to 1 pint. A still, similar to a large steam boiler with a dome and manhole, is employed. This still is provided with two sets of coiled tubing inside, one set being perforated for admission of steam. The crude petroleum is first placed in the still, and blown by direct steam for six or eight hours, till the lighter impurities have passed out to a suitable condenser. The lead acetate and zinc sulphate are then added to the petroleum. The contents of the still are heated by sending steam through the coil of closed tubing, till the solution has boiled for an hour. The beeswax, resin and rubber are then added, and the ingredients boiled together for about seven hours. The mixture is then allowed to cool, and the linseed oil added.

THE SCRAP HEAP.

Notes.

A press dispatch from Pittston, Pa., announces that 200 trainmen of the Lehigh Valley have had to leave Sayre and make their homes in Pittston so as to conform to a new arrangement of terminals.

Several men who went to work on the Lehigh Valley at the time of the strike, and subsequently left at the request of the strikers, are now suing the Order of Railway Trainmen for money that they say was promised them.

On March 1 the pay of firemen and brakemen on the Philadelphia & Reading was reduced so as to make the maximum rate for firemen $2.10 a day (or for a trip of 100 miles or less) and for freight brakemen $2. Passenger brakemen were reduced to $1.80.

A bridge of the Chesapeake & Ohio on the Cohen Creek Branch near Charleston, W. Va.; was burned down by a mob of 100 rioters from the Eagle coal mines on the morning of March 3. The militia had to be called out to keep order among the striking miners.

Thirty-two employees of the Cleveland, Cincinnati, Chicago & St. Louis at Indianapolis have been dismissed because their wages were garnisheed. The man who sued them was a saloonkeeper, which perhaps explains why the pay-your-debts rule was so strictly enforced.

President Perkins, of the Chicago, Burlington & Quincy, is quoted as stating that the number of idle railroad men in the towns on his lines is not less than 10,000, and that no one can tell when it will be possible to give them employment; and that the Burlington has 2,000 cars that ought to go into the shops, but the available funds of the company are more urgently needed in other directions.

A bill has been presented in the Iowa Legislature to require every railroad to provide track scales before July 1, 1895, at every station where 100 cars of grain, seeds and wheat are shipped, *by all roads*, [annually?]. A clause in the bill requires the roads to give bills of lading guaranteeing the weight of shipments. In Massachusetts a bill has been reported compelling the railroads of the state to put automatic couplers on their freight cars. The law on this subject, which has been on the books in that state several years, was practically useless, and the Railroad Commissioners, in their last report, recommend its repeal; but the members of the legislature seem to be very fearful that this proposal is an attack on their "liberties." The Senate Committee on Interstate Commerce held hearings at Washington last week on the proposal to amend the Interstate Commerce law so as to permit traffic pools. Mr. George R. Blanchard was the principal witness.

On the night of March 2, near St. Joseph, Mo., a passenger train of the Chicago, Rock Island & Pacific escaped an attack by train robbers by the quick wit of the engineman, Mr. McKinney. Encountering a red light under suspicious circumstances, he kept a sharp lookout, and before he stopped saw men ahead with guns, whereupon he put on steam, and, with his fireman, dropped to the footplate, avoiding a volley of bullets. According to the reports many bullet holes were afterward found in the engine and cars.

The President of the American Humane Association has written to a number of railroad officers calling their attention to a complaint from Pittsburgh that cattle dealers in Chicago send cattle East in charge of irresponsible attendants (tramps), who neglect the animals.

At West Manayunk, Pa., on March 3, 12 men were sent to jail for 20 days each for stealing rides on Philadelphia & Reading trains.

A Pass Fraud.

We are informed by Mr. Charles S. Lee, General Passenger Agent of the Lehigh Valley, that applications have been presented to various railroad officers for transportation and other favors on account of the Lehigh Valley by one C. H. Cooke, who claims to be an employee of that road; but that the man is not in the service of the company, and has no authority to make such requests.

BRIDGE BUILDING.

Allentown, Pa.—A petition has been numerously signed, asking the Court to appoint viewers on the site of a new highway bridge from Fifth and Lawrence streets to Salisbury.

Butler County, O.—A bill has been introduced in the Legislature authorizing the commissioners of this county to spend $10,000 in the erection of a bridge over Gregory's Creek, Lemon Township.

Drayton, Ont.—The contract for the new bridge to be constructed here has been awarded to the Central Bridge & Engineering Co., of Peterboro, Ont., and the cost will be about $2,000.

Little Falls, Minn.—The Pine Tree Lumber Company has submitted a proposition to the city council to pay one-half of the cost of a wagon bridge across the Mississippi River, the completed structure to be turned over to the city for maintenance. As the citizens generally favor the project it is very probable that the council will accept the proposition.

Marion, N. J.—Negotiations have been opened between the Pennsylvania Railroad and the Hudson County Boulevard Company, of New Jersey, for the construction of a large two-span bridge over the tracks of the Pennsylvania at a point between Marion and Jersey City. The object is to avoid a dangerous grade crossing.

Monaca, Pa.—The Pittsburgh & Lake Erie will shortly begin the erection of a double-track trestle bridge over Markey's Run, at this place, to take the place of the present structure. A heavy fill is also to be made to take the place of the present long and high trestle.

Ottawa, Ont.—A bridge will be built by the city corporation across the canal at Concession street, also a bridge across the Rideau River.

Pittsburgh, Pa —Representative Dalzell, of Pennsylvania, has introduced a bill in Congress to authorize the building of a bridge over the Monongahela River, from Twenty-second street to Brady street. The bridge is to have a span of not less than 500 ft. and to have a clear height of 53 ft. above low water mark.

South St. Paul, Minn.—It is reported from St. Louis that the contract for constructing the combination railroad and wagon bridge has been awarded to J. Stewart & Co., of that city. This is the bridge proposed to be erected by the Belt Line Railway Company, and the dispatches state that the contract price is $1,500,000. It will consist of four spans of 150 ft. each, and a draw 480 ft. in length. The plans have recently been approved by the Secretary of War, and the officials of the compapp have been in the East for some time, it was understood, arranging for the construction of the bridge. On account of their absence from St. Paul, it is impossible to verify the St. Louis report. South St. Paul, Newport and St. Paul Park voted bonds in aid of the enterprise, but as the work was not begun within the specified time, some of them have been canceled. A small gang of men has been at work for the past two weeks excavating for the abutment foundations.

Summerside, P. E. I.—Mr. George Baker, of this town, has prepared plans for a new bridge to be erected here.

Sunicksburg, Pa.—The matter of replacing the present old bridge across the Little Mahoning between this place and West Mahoning with a new iron structure is being agitated.

Urbana, O.—A bill has been introduced in the Ohio Legislature to place the building of bridges in this county in the hands of the county commissioners instead of the road superintendents.

Wroxeter, Ont.—Tenders are being received by John Ansley, County Commissioner at Wingham P. O., for the superstructure of an iron or steel bridge to be erected over the Maitland River, in this village, county of Huron. The bridge is to have one span of 125 ft. long, roadway 16 ft. wide, and one sidewalk 5 ft. clear, and is to be completed by Aug. 15 next.

Yankton, S. D.—Press dispatches state that W. J. Waldo, Chief Engineer of the Missouri Valley Bridge Co., of Leavenworth, Kan., has been at Yankton, S. D., for some days making soundings of the Missouri River at that city for a proposed combination railroad and wagon drawbridge over the Missouri River. It is said that the bridge company has agreed to build such a bridge at that point, having a contract from two railroad companies guaranteeing the bridge company an annual rental of $16,000 for the bridge. The plans of the bridge, it is said, will be ready to submit to the Secretary of War at Washington, D. C., on June 1.

MEETINGS AND ANNOUNCEMENTS.

Dividends:

Dividends on the capital stocks of railroad companies have been declared as follows:

Chicago & Eastern Illinois, quarterly, 1½ per cent. on the preferred stock, payable April 2.

Delaware & Hudson Canal, quarterly, 1¾ per cent., payable March 15.

New York & Harlem, 3 per cent. on the preferred and common stock, from the earnings of the city line, payable April 2.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Atlanta & Charlotte Air Line, annual, New York City, March 14.

Atlantic & Northwest, special, Montreal, Quebec, March 27. To authorize the issue of bonds for the construction of the road, and to approve of the lease to the Canadian Pacific.

Canadian Pacific, annual, Montreal, Quebec, April 4.

Chicago & Alton, annual, Chicago, Ill., April 2.

Elmira, Cortland & Northern, annual, New York City, March 13.

Georgetown & Western, annual, New York City, March 13.

Grand River Valley, Jackson, Mich., April 25.

Joliet & Chicago, annual, Chicago, Ill., April 2.

Missouri Pacific, annual, St. Louis, Mo., March 13.

New York & New England, annual, Boston, Mass., March 13.

New York & Rockaway Beach, annual, New York City, March 27.

Oregon, Short Line & Utah Northern, annual, Salt Lake City, Utah, March 21.

Pennsylvania, annual, Philadelphia, Pa., March 13.

St. Louis, Iron Mountain & Southern, annual, St. Louis, Mo., March 13.

Toledo, Ann Arbor & North Michigan, annual, Toledo, O., April 18.

Wabash, annual, St. Louis, Mo., March 13.

Western Terminal Co., special, Pittsburgh, Pa., Mar. 20.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Master Car Builders' Association* will hold its annual convention at Saratoga, N. Y., beginning June 12. The hotel headquarters will be at Congress Hall, H. S. Clements, Manager.

The *Master Mechanics' Association* will hold its annual convention at Saratoga, N. Y., beginning June 18.

The *Freight Claim Association* will hold its annual meeting in Louisville, Ky., March 14.

The *National Association of Local Freight Agents* will hold its annual convention at Pittsburgh, Pa., June 12, 13, 14. The headquarters will be at the Monongahela House.

The *American Association of General Passenger and Ticket Agents* will hold its next annual meeting at the Hotel Royal Poinciana, Lake Worth, Fla., March 20.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Wednesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the fourth Wednesday of January, March, April, September and October. The next meeting will be on Wednesday, March 28.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November. The next meeting will be on Thursday, April 19, at 10 a. m.

The *Western Railway Club* meets in the rooms of the Central Traffic Association, Monadnock Building, Chicago, on the third Tuesday in each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *Northwest Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, except during June, July and August, at 8 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Tacoma Society of Civil Engineers and Architects* meets in its rooms, 201 Washington Building, Tacoma, Wash., on the third Friday in each month.

The *Association of Engineers of Virginia* holds informal meetings the third Wednesday of each month, from September to May, inclusive, at 710 Terry Building, Roanoke, at 8 p. m. The next meeting will be held on Wednesday, March 21. The subject will be Blast Furnace Construction.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, 36 Bromfield street, Boston, on the third Wednesday in each month, at 7:30 p. m.

The *Western Society of Engineers* meets on the first Wednesday in each month, at 8 p. m. The headquarters of the society are at 51 Lakeside Building, Chicago.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas Place, St. Louis, on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Engineers' Society of Western Pennsylvania* meets at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month at 7:30 p. m.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. The next meeting will be Friday, March 16.

The *Engineers' and Architects' Club of Louisville* meets in the Norton Building, Fourth avenue and Jefferson street, on the second Thursday in each month.

The *Civil Engineers' Society of St. Paul* meets on the first Monday of each month, except during June, July, August and September.

The *Scandinavian Engineering Society of Chicago* meets in room 309, Title and Trust Building, 100 Washington street, on the third Thursday in each month.

Association of Engineers of Virginia.

The next meeting of the club will be held on Wednesday, March 21, at their rooms, 710 Terry Building, Roanoke, Va. The subject for discussion will be "Blast Furnace Construction."

Western Society of Engineers.

A meeting of the Society was held at the Grand Pacific Hotel on Wednesday evening, March 7, 1894, at 8 p. m.

A paper, "Some Notes on the German Collective Exhibit of Engineering at the World's Columbian Exposition," was read by Mr. Charles J. Roney.

Northwest Railroad Club.

At the regular meeting, at the Ryan Hotel, St. Paul, on March 16, S. L. Bean, Master Mechanic of the Northern Pacific, will read a paper on "Brick Arches in Locomotive Fire Boxes," and E. A. Williams, Master Mechanic of the Minneapolis, St. Paul & Sault Ste. Marie, will read one on "Care of Passenger Trains at Terminals."

The Engineers' Club of Philadelphia.

A business meeting of the Club was held March 3. The following papers were presented: Comments on Current Practice in the Designing of Plate Girders. By Prof. Edgar Marburg. The Old Viaduct Bridge over the Conemaugh. (Illustrated by lantern slides.) By J. Chester Wilson.

At the regular meeting, Feb. 17, President John C. Trautwine, Jr., occupied the chair, and 53 members and visitors were present.

Mr. W. B. Reigner presented a description of the new falls of Schuylkill bridge, on the Philadelphia & Reading, in Philadelphia. This bridge consists of an 80-ft. stone arch over the East Park Drive, and eight deck plate girder spans, one of 60 ft., one of 92 ft. and six of 87 ft. c. to c. of piers, over the river and adjacent low ground and the West Park Drive. It carries two tracks, 13 ft. c. to c. The alignment is a 6-deg. curve, and the gradient is .25 per cent. rising to the eastward.

For founding the river piers upon the rockbed, a floating coffer-dam was used entirely, similar to one used some years ago for removing rock obstructions from the canal channel, and described by Mr. Edwin F. Smith in Volume IV., No. 4, of the Club's Proceedings. When in position for work, the dam is rectangular in shape, 62 ft. long by 36 ft. wide outside, and 16 ft. high. Each side consists of a timber crib-work 10 ft. wide, with a movable timber at each corner, extending vertically from the bottom of the crib to some distance above the top. These timbers are shod with iron on the bottom, and serve to hold the dam in position while the sheet piling is being done. In working the dam, the two sections into which it is divided are united and placed in the required position. The corner spuds are dropped, and the crib-work is sunk by letting water into the watertight compartments in each section, and putting in the necessary amount of stone. Irregularities in bearing at the bottom rock are blocked up by a submarine diver. Close sheet piling of jointed plank, 3 or 4 in. thick, is then spiked to the cribs, and puddle, composed of clay and gravel, thrown around the bottom outside, makes it ready to be pumped out. To make a complete shift of the dam from one pier to the next occupied a gang of six men about six or eight days. With one of the foundations, which required much leveling, there was considerable trouble to keep the water out, but the leaks were finally stopped by using bunny bags around them, the bags being drawn into the crevices by the force of the water, and thus holding the puddle. The floating dam was used for the three piers in the river channel, and is still in good condition to be used again if needed, the one from which it was copied having been used for over twenty settings. The two piers near the shore were put in with ordinary dams. The metal in the superstructure is wrought iron, no steel being used. The girders are all 90 in. deep out to out of angles, and are, on account of the curvature, spaced 8 ft. centers under each track, instead of the usual Philadelphia & Reading standard of 6 ft. Over the East Park Drive is a stone segmental arch of 80-ft. span and 26-ft. rise, exceeding by 2 ft. the span of the adjacent skew arch, built in 1854, making it the longest on the Reading road. The center for the construction of this arch is so designed as to give a clearance of 12 ft. over the Park Drive, which placed the bottom chord of the ribs 8 ft. above the springing-line of the arch, making it necessary to attach an overhanging portion to each end to get the full length of the ring. The total length of the bridge from the west back wall to the east springing-line of the arch is 769 ft. The height from the base of low rail to ordinary water surface is 47½ ft. The work was commenced in May, 1889, and finished in February, 1890, considerable time having been lost by a change of contractors and by floods in the river. The entire cost of the bridge was about $175,000, including the short approaches. In the discussion some points were brought up as to the change in the curvature due to expansion and the advantage of using four girders in the span of the arch instead of three. Prof. Marburg said that with three girders the saving in cost of material and workmanship amounted to about 12 per cent., and unless there was some exceptional reason, such as curvature, it would seem better to use three girders instead of four.

President Trautwine called the attention of the meeting to an interesting problem which occurred in supplying a village with water. The water was fed from a reservoir through a 10 in. pipe, for a distance of 8,000 ft., to locomotives and fire-plugs in the village. The fall in the pipe was 40 ft., and the head in the reservoir 20 ft. At the village, this pipe separated into two branches 6 in. in diameter, one, 3,200 ft. long, running to another village, with a fall of 340 ft., and the other about 1,500 ft. long, running to a head house, and in this distance first rising 2 ft., then falling about 10 ft. to the upper story of the head house, and 15 ft. further to the cellar. The difficulty experienced was, that owing to the much greater head in the long pipe, the valley at its end got all the water, leaving practically none for the head house at the top of the plain. The trouble was remedied by the simple expedient of introducing in the long pipe, just below the branch, a siphon about 18½ ft. high, provided at the top with a blow-off cock, by which the air is allowed to escape when it accumulates in too great quantities.

PERSONAL.

—Mr. H. W. Smith has been appointed Master Mechanic of the St. Louis Merchants' Bridge Terminal in charge of the motive power and car department.

—Mr. Rollin H. Wilbur, General Superintendent of the Eastern Division of the Lehigh Valley Railroad, has been appointed General Superintendent of the entire line, from Jersey City to Buffalo.

—Mr. Charles M. Crump, Secretary and Assistant Treasurer of the Richmond & Danville, died in Philadelphia Feb. 23, aged 53 years. He was in the service of the Richmond & Danville for nearly 30 years, and was Auditor for a time, and was appointed Secretary and Assistant Treasurer in 1892.

—Mr. George G. Lobdell, President of the Lobdell Car Wheel Company, died at Wilmington, Del., on March 1, aged 77 years. He had been in the car-wheel business over 55 years. The new firm was known at first as Bush & Lobdell. The Lobdell Car Wheel Company was formed in 1867. Mr. Lobdell invented several forms of wheels and built up one of the largest industries of its kind in this country.

—Mr. W. A. Robinson, Purchasing Agent and Assistant to the General Manager of the Brooklyn Elevated Railroad, has resigned and the office has been abolished. Mr. Robinson was appointed to this position in July last, having been previously Assistant to the General Manager on the St. Louis Southwestern and before that Purchasing Agent and Assistant to the General Manager on the Cairo Short Line.

—Mr. George W. Board has been elected Secretary of the Northern Pacific Railroad Company to succeed Mr. George H. Earle, who resigned a few weeks ago. Mr. Earle was also acting as Secretary of the Receivers, as well as for the railroad company, having been reappointed to that position by the present management. He resigned from the company's service when the directors began suits for the removal of the Receivers.

—Mr. H. O. Schwanecke, civil engineer, died in St. Louis, Mo., Feb. 26, after a lingering sickness of six years. He came from Hanover, Germany, where he was educated, in 1881. He was Assistant Engineer on the Pittsburgh & Western road and Engineer in Charge of Construction of the Pittsburgh Junction Ry., Engineer of the Pittsburgh & New York Short Line, Engineer of the Wheeling Bridge Co., retiring from active work several years ago on account of his poor health.

—Mr. Clarence H. Howard, Secretary of the Safety Car Heating & Lighting Co., and one of the best known young men in the railroad supply trade, was married at Denver, Col., on Feb. 22, to Miss Minnie Morey, only daughter of Mr. Franklin Morey, a prominent business man of that city and a pioneer in Colorado. Mr. Howard and his wife left Denver on the evening of their marriage for a visit to the Midwinter Fair in San Francisco, and they afterward went to the City of Mexico and other Southern resorts.

—Mr. James Harrington, who has been Chief Engineer of the Cleveland, Akron & Columbus road since February, 1887, has resigned. Mr. Harrington was formerly connected in different capacities, as Engineer, with the following roads: Illinois Southern in 1857; Mobile & Ohio in 1860 and again in 1867; New Orleans & Ohio in 1867; Paducah & Memphis in 1872; Chief Engineer, Memphis & Little Rock, in 1875 to 1880; General Manager, in 1880; Chief Engineer of the Tampico Extension of the Mexican Central in 1883, and subsequently with the Memphis & Little Rock as Treasurer and Freight Agent; with the Batesville & Brinkley and since 1887 with the Cleveland, Akron & Columbus. In 1891 he became General Superintendent.

—Judge J. W. McDill, of the Interstate Commerce Commission, died at Creston, Ia., on Feb. 28, of typhoid fever. He was appointed a member of the Interstate Commerce Commission in January, 1892, to succeed Judge Thomas M. Cooley. Previously he had been on the Iowa Railroad Commission for six years, up to 1890. Judge McDill was born in Ohio in March, 1834, was educated in the public schools and at Miami University, and afterward studied law at Columbus. In 1856 he moved to Iowa, and soon after was elected County Judge in Union County. In 1861 he went to Washington as clerk of a Senate Committee, and in 1865 returned to Iowa and was made first a circuit and then a district judge. He served in Congress two terms and was a member of the committee on the Pacific railroads. In 1878 he was a member of the State Railroad Commission, serving until 1881, when he was elected to the United States Senate to fill an unexpired term. He was then again appointed to the Iowa Railroad Commission.

—Captain John G. Mann, Assistant Chief Engineer of the Illinois Central, has been appointed Assistant General Superintendent of the Mobile & Ohio. Captain Mann was formerly in the service of the Mobile & Ohio for many years in various positions. In 1854 he was Resident Engineer on the road in Tennessee and was afterward Division Engineer and later also Assistant Treasurer for a short period. He served through the war in the Confederate Army and between 1865 and 1867 was again with the Mobile & Ohio as General Freight and Passenger Agent. For about 22 years he has been connected with the engineering and transportation department on roads now comprised in the Southern System of the Illinois Central Railroad. He was Division Engineer on the extension of the Mississippi Central road from Jackson, Tenn., to Cairo, Ill., and was afterward Superintendent of that line. In 1882 he became Chief Engineer of the Yazoo & Mississippi Valley and the Canton & Aberdeen road and was in charge of the construction of these roads for the Illinois Central. After the building of these branches he became Superintendent of the Southern lines of the Illinois Central at New Orleans until 1892, when he was appointed Assistant Chief Engineer, being located first at Chicago and afterward at New Orleans.

ELECTIONS AND APPOINTMENTS.

Alabama Mineral.—Walter E. Knox, formerly Acting Superintendent, has been appointed Superintendent, with office at Anniston, Ala., vice Thomas K. Scott, resigned. This line is a branch of the Louisville & Nashville.

Atlantic & Danville.—F. C. Brogan has been appointed Car Accountant, with office at Lawrenceville, Va.

Baltimore & Northern.—The annual meeting was held in Baltimore, Md., March 1, and the following directors were elected: William Gilmor, M. H. Houseman, Fridge Murdoch, G. O. Wilson, S. Johnson Poe, Solomon Frank and John Henry Miller.

Chazy.—The following are the directors of this company, which was incorporated in New York last week: John I. Platt, James B. Platt, Edmund P. Platt, Edmund Platt, Thomas B. Scott, H. S. Sherwood, George W. Davids, John H. Swertfager, Samuel C. Chase, all of Poughkeepsie, N. Y.

Chicago Great Western.—J. J. McLaughlin, Superintendent of the St. Paul division, has resigned, and the duties of that office will be performed by J. Berlingett, Assistant General Superintendent, whose office is at Oelwein, Ia.

Cincinnati & Muskingum Valley.—S. B Liggett, Secretary of the Pennsylvania Lines, has been appointed Secretary of this company, with office at Pittsburgh, Pa., vice C. H. Walton.

Cleveland, Canton & Southern.—W. H. Woodward has been appointed Auditor, with office at Cleveland, O., vice A. Thierry.

Cleveland, Cincinnati, Chicago & St. Louis.—W. G. Bailey has been appointed Superintendent of the Cairo Division, to succeed B. S. Sutton, resigned. Mr. Bailey was formerly Engineer of Maintenance of Way, and will continue to perform the duties of that office.

Concord & Montreal.—T. A. Mackinnon's resignation as General Manager having been accepted, the following appointments have been made: B. A. Kimball, Managing Director, and D. C. Prescott, General Superintendent and Traffic Manager.

Des Moines, Northern & Western.—W. R. Warfield has been elected Vice-President, with headquarters at Des Moines, Ia.

Detroit, Bay City & Alpena.—George M. Crocker has been appointed Auditor, with headquarters at Detroit, Mich.

Duluth, South Shore & Atlantic.—George H. Church has been appointed Secretary, vice L. M. Schevan, and has also been appointed Assistant Treasurer, with headquarters at 45 William street, New York City.

Elkton, Massey's & Middletown.—The following directors have been elected: John H. Jamar, of Elkton, Md.; George S. Woolley and H. H. Brady, of Chesapeake City; Samuel C. Rowland and Jacob Tome, of Port Deposit; Samuel Rea and H. D. Welsh, of Philadelphia. The directors elected Jacob Tome, President; Samuel Rea, Vice-President, and William F. Schwarz, Secretary and Treasurer.

Findlay, Fort Wayne & Western.—I. H. Burgoon, formerly Superintendent of the Peoria Division of the Terre Haute & Indianapolis, has been appointed General Superintendent of this road, with headquarters at Ottawa, O.

Georgia, Southern & Florida.—W. H. Lucas has been appointed Florida Passenger Agent, with headquarters at 77 W. Bay street, Jacksonville, to succeed W. L. Jones, who has been appointed Freight Agent of the Richmond & Danville, with headquarters at Jacksonville.

Glendon & Gulf.—George F. Edmiston, Vice-President, having resigned as General Manager, Frank D. Jones will act as General Manager, with office at Gulf, N. C., in addition to his duties as Chief Engineer.

Hahnville & Boutte.—At a meeting held in New Orleans, Feb. 26, the following directors were elected: J. A. Morris, Thomas Sully, M. R. Bein, C. E. Rice, James Legendre and T. L. Macon. The following officers were elected: President, C. E. Rice; Secretary, James Legendre, and Manager, M. R. Bein.

Kansas City Suburban Belt.—William S. Taylor, Secretary and Purchasing Agent, has been elected Treasurer in addition to his other duties.

Louisville Southern.—V. B. Lang, General Foreman of the West Shore shops at New Durham, N. J., has been appointed Master Mechanic with headquarters at Louisville, Ky.

New York Central & Hudson River.—L. M. Allen has been appointed Division Freight Agent in charge of the freight traffic of the New York & Putnam road. His office will be at the Grand Central Station, New York City.

New York, Chicago & St. Louis.—George W. Vaughan has been appointed Engineer of Maintenance of Way, with office at Cleveland, O.

New York, Lake Erie & Western.—Bernard Clark, Foreman of the car shops at Buffalo, has been appointed Mechanical Engineer at Susquehanna, Pa., to succeed F. A. Hibbits, promoted to be Master Mechanic at Rochester, N. Y.

New York, Susquehanna & Western.—George M. Hughes has been appointed General Agent of this company, with office at 15 Cortlandt street, New York.

Pittsburgh, Shenango & Lake Erie.—E. B. Gilbert has been appointed Master Mechanic, with headquarters at Greenville, Pa., vice E. Richardson, deceased.

Queen Annes.—The following are the incorporators of this new Maryland company: John B. Brown, B. Palmer Keating and Wm. W. Busteed, of Centreville, Md., and Isaac W. Troxel and H. L. Pope, of Baltimore.

Richmond & Danville.—W. L. Jones, formerly Florida Passenger Agent of the Georgia Southern & Florida, has been appointed General Agent of this company, with headquarters at Jacksonville, Fla.

St. Paul & Duluth.—A. V. Williams has been appointed Assistant Treasurer, with headquarters at St. Paul, Minn., vice W. H. Coleman, resigned. T. L. McClury has been appointed Paymaster.

Texas, Louisiana & Eastern.—D. D. Donahue has been appointed Auditor and General Freight and Passenger Agent, with headquarters at Conroe, Tex.

Pullman's Palace Car Co.—Capt. R. C. Edwards, for two years agent of the company in Nashville, Tenn., has been appointed a District Superintendent, with headquarters at Richmond, Va.

Vandalia.—J. D. Morehead, formerly round-house foreman at Terre Haute, has been appointed Master Mechanic at Paris, Ill.

RAILROAD CONSTRUCTION, Incorporations, Surveys, Etc.

Allouez Bay.—The incorporation of this company in Wisconsin was noted last week. The route of the projected road is from a point on Allouez Bay, in the city of Superior, Douglas County, Wis., south around Allouez Bay, keeping within a distance of two miles from the bay to the western end of Wisconsin Point, on the north side of Allouez Bay. The distance is about eight miles. The incorporators are Francis B. Clark, of St. Paul, Minn.; Thomas W. Shackleford, Frank L. Taylor, George N. Foresman and E. B. Manwaring, of Superior, Wis.

Central Railway & Bridge Co.—The company is seeking incorporation from the Dominion Government to build a railroad from a point on the Montreal, Portland & Boston road in Longueuil, Que., to connect with the Canadian Pacific at Dalhousie station, in Montreal, with power to erect a bridge across the St. Lawrence River.

Chicago, Paducah & Memphis.—The survey being made by the Chief Engineer, T. P. Reed, of St. Elmo, Ill., is now being continued south of Mount Vernon. The surveyors have been in the field locating since Jan. 15th. The engineers made a preliminary survey from St. Elmo, Ill., to Benton, Ill., then returned to St. Elmo and commenced the location, and have located from St. Elmo, Ill., to Mount Vernon, a distance of 50 miles. This line is to extend from Altamont, Ill., to a point opposite Paducah, Ky., a distance of 150 miles. The principal towns along the line are Altamont, St. Elmo, Kinmundy, Salem, Mount Vernon, Benton, Marion, Vienna and Metropolis. The contract has been let to Johnson Bros. & Faught, of St. Elmo. The maximum grade will be one per cent. The curvature four degrees. The right of way is being secured as rapidly as the line is located, and it is said that construction will be begun as soon as the line can be prepared.

Chicago, St. Paul, Minneapolis & Omaha.—It is reported that this road will build an extension from Mitchell, S. D., to Wheeler as soon as it is definitely decided to open the Yankton Indian reservation for settlement.

Delaware, Lackawanna & Western.—The company has had under way since last May important improvements on the Morris & Essex division between Millburn and Summit, N. J. The distance is four miles. The work consists of raising the roadbed, reducing the grade between Short Hills and Summit, three miles, reducing the curvature and eliminating all grade crossings. The present roadbed all the way from Short Hills to Summit is built on the south side of what is known as the "second mountain," a spur of the Blue Ridge, and owing to the numerous sharp single and reverse curves good time could not be made and many accidents occurred at crossings. In straightening the line it has been necessary to do extensive filling in and excavating and in one place at Huntly, about 150 ft. of rock had to be blasted out. On the new line the grade from a point one-eighth of a mile west of Millburn ascends 80 ft. to the mile continuously to Summit, except a half mile section at Short Hills which is 50 ft. to the mile, reducing the grade of the present line 17 ft. At Millburn a six degree curve is eliminated and a four-degree curve substituted. At the county road a ten-degree curve is reduced to one of three degrees. West of the county road a ten-degree curve is reduced to one of five degrees. Seven new bridges are included in the improvements. The first is a stone arch spanning a creek near Millburn. All the public highways at Short Hills are crossed on steel bridges. It was necessary to depress the highways at Short Hills and build a new highway to permit of this. All the highway bridges are of steel with the finest dressed stone abutments, and they vary in length of span from 30 to 50 ft. At the Morris and Elizabeth turnpike a second stone arch bridge with a 38-ft. span has been built. The stone arch bridges are built of dressed stone. A costly and handsome station and freight house will be built at Millburn to replace the structure burned more than a year ago. The Short Hills station has been moved back several feet and raised to meet the grade of the new line. The contractors on all the roadway and bridge work are Messrs. Page and Burke Brothers, of Scranton. The Passaic Rolling Mill Co., of Paterson, N. J., are contractors for the steel bridges. The cost of the work will exceed $300,000. Part of the new line between Huntly and Short Hills has been in use for over a month. The entire new roadbed will probably be in use by June. The work is carried on under the supervision of the company's engineers.

Elkton, Massey & Middletown.—The failure of the attempt to charter the Elkton & Southern Railroad in Maryland, and transfer to that company the $58,000 filed by the state some years ago to this line, has revived interest in the older project, and it is stated that an effort will now be made to build the road and earn the subsidy. At a meeting of the old incorporators at Elkton, Md., last week, new directors, several representing the Pennsylvania Railroad, were elected. Jacob Tome, of Port Deposit, was chosen President, and Samuel Rea, of the Pennsylvania, was elected Vice-President. The capital stock of the company, $250,000, was all subscribed at this meeting, the majority of it for the Pennsylvania. The bill now before the Maryland Legislature provides that the work shall begin within three months, and that the line shall be completed as far as Cecilton within a year. The line will connect at Massey with the Delaware Railroad, one of the Pennsylvania lines, and connection will be also made with that road at Elkton.

Flint & Pere Marquette.—This company is building a branch from Baldwin, Mich., north 10 miles to a large tract of pine timber.

Fresno & Monterey.—E. H. Nichol, of New York, who went to California some months ago to make a report on this projected railroad, has now returned to New York. Though his report has not been made public he told the reporters of the local papers that it would be favorable to the enterprise. A. W. Jones, the President of the company, is now also on his way from Fresno, Cal., to New York and expects to complete arrangements for starting work on the line. The Knickerbocker Trust Co., of New York, is the trustee for the mortgage already issued, but it is understood that that company is not interested financially in the project. President Jones talks of having the contracts let and work started some time in May. The route has been surveyed by E. H. Dandridge, from Monterey on the Pacific Coast to Fresno in the San Joaquin Valley, a distance of 170 miles, of which about 40 miles will be through a mountainous country. From Monterey the surveys have been run northeast to Salinas, thence to Hollister, beyond which the line goes through the Coast Range and into the San Joaquin Valley, crossing the latter to Firebaugh and Madera and to Fresno City.

Gladeville.—The grading on this line is now entirely completed between Ramsey on the Norfolk & Western and Gladeville, Va., a distance of a little over three miles. The contractors for the grading were Wing & Horneck, of Wise, Va. The tracklaying will begin immediately. The Chief Engineer of the line is Emile Low, of Saltville, Va. E. M. Fulton, of Wise C. H., Va., is President of the company.

Great Northern.—Vice-President Clough confirms the report that the direct line from the Red River Valley to Duluth will be completed this year. President Hill is now in London and will in all probability arrange for disposing of the bonds before his return. The road now terminates at Frosston, Minn., and the delay is caused by the inability of the company to build across the Indian reservations in Northern Minnesota until Congress passes the enabling act which is now under consideration by the Senate. Work will be begun as soon as this obstacle is removed, and the line will, doubtless, be graded and the track laid this year.

Interstate & Gulf.—F. J. Close, of Topeka, Secretary of the railroad, announces to the local newspapers that the Executive Committee has let a contract to C. J. Jones and others for the grading of 200 miles of road from Port Bolivar, near Galveston, northeast. Mr. Close announces that he will go east soon to negotiate for 100 miles of rails.

Kinsman & Farmdale.—This company has been formed in Ohio to construct a railroad from Kinsman, connecting with the Lake Shore & Michigan Southern, to Farmdale, a distance of 1½ miles. The construction will include a trestle half a mile long. The officers are President D. M. Yeomans, Secretary and Treasurer Frank W. Fobes and Engineer S. C. Yoder, all of Kinsman.

Market Street, Richmond & Frankford Elevated Electric.—The ordinance authorizing the construction of this proposed elevated electric railroad in Philadelphia has been passed by the Common Council, and has become a law through the approval of Mayor Stuart. The ordinance, as already stated, provides that electricity or some other power than steam locomotives must be used on the line. The projectors give the impression that they have decided to use the system employed on the Intra-Mural Railroad at the World's Fair Ground last summer. The city terminus of the line will be on Market street, and the stations will be located between Eighth and Ninth streets on the site of the present Central Avenue Hotel. The road is to extend north to Race street, and options have already been secured on property as far as that street. The iron work, it is stated, will be furnished by the Phœnixville Bridge Co. and from Pittsburgh. One of the Philadelphia papers reports that the banking firm of Seligman & Co., of New York, are interested in the enterprise. Theodore W. Cramp, of Philadelphia, is the President of the company.

Mississippi River & Bonne Terre.—The change of gage on this road from narrow to standard gage was completed to its southern terminus at Doe Run, Mo., last week, and standard gage cars are now running over the entire line from Riverside, south of St. Louis to Doe Run, 47 miles.

Nakusp & Slocan.—The roadbed of this railroad, which is being built as a branch of the Canadian Pacific Railroad in British Columbia, is now ready for the rails, for the entire distance from Nakusp, on that road, to Three Forks, B. C., which is to be the terminus of the line. The distance between these points is 38 miles, and the track for the first six or eight miles is already finished. The road is being built by the Inland Construction and Development Co., of Vancouver, B. C. The special contractors under that company have finished their work; the bridges have been built and the rails will be laid immediately.

New Roads.—A line is being run by a party of engineers from Cogan Station up Hoagland's Run, Lycoming County, Pa., to the Coal and Babst mountains, a distance of about eight miles. It is stated that the proposed line will intersect with the Northern Central, near Cogan Station, following along Hoagland's Run, about five miles. At the base of Coal Mountain, about two miles further up the Run, quarries of flagstone are being developed.

Palestine & Dallas.—The committee appointed at Palestine, Tex., to secure a subscription from that city of $40,000 for this proposed railroad, report that all but $10,000 of this amount has been subscribed. H. C. Wright, the Chairman of the committee, is confident that the balance will be secured within the next two weeks. George W. Burkitt, who is the chief projector, repeats his assurance that the actual work between Palestine and Dallas will be commenced within a month after this fund has been secured. The distance between the two towns by the proposed line is about 90 miles.

Path Valley.—An additional force of men will be put to work in a couple of weeks laying track up to the tunnel, beyond New Germantown. Operations are being pushed from both ends. This new line is an extension of the Newport & Sherman's Valley from New Germantown, Perry County, to Fannettsburg, Franklin County, Pa.

Raleigh & Western.—This North Carolina road is now reported to be completed as far as Harper's in Chatham County. This point is 16 miles west of Egypt, which is the terminus of the operated line of the company. The road is completed from Colon to Egypt, about 10 miles, but little tracklaying has been done beyond the latter town.

Revelstoke & Arrow Lake.—The chief work now being done on this line is on the four miles south of the end of track below Revelstoke, B. C., where some difficult rock work along the Columbia River has to be done. The track has been laid 10 miles south of Revelstoke, which is on the main line of the Canadian Pacific. Beyond the present terminus there are two tunnels to be built which will delay any rapid work. The contract for the entire line, which follows the Columbia River to Arrow Lake, 38 miles south of Revelstoke, has been let to D. McGillivray & Co. The subcontractors under that firm are M. J. Henry & Co., D. Robinson & Co., John H. O'Leary & Co., and Welch & Jachetta. Besides the heavy rock referred to, the contractors have three trestles, 200 ft., 350 ft., and 400 ft., to build, besides 16 bridges over 90 ft. in length. George H. Richardson, of Revelstoke, is the Chief Engineer of the line, and John G. Whyte is Superintendent of Construction.

Richmond & Manassas.—Few railroad bills before the Virginia Legislature in the past few years have attracted more attention than that granting a charter to this company. The act granting the charter requires

the company to deposit as a guaranty $100,000 worth of Virginia bonds, worth now about $60,000, to begin construction by Jan. 1, 1896. The new company is required also to build 20 miles of the road within a year after Jan. 1, 1896, or forfeit its charter. According to the act providing for the sale of the State's stock in the Richmond, Fredericksburg & Potomac Railroad at not less than certain stipulated figures, puts the burden of the purchase of that stock on the friends of the new charter, for unless the State's stock is sold the Richmond & Manassas cannot proceed with construction. The amount of money required to buy the stock is over $600,000.

St. Clair, Madison & St. Louis Belt.—For some weeks past a party of engineers have been revising the surveys of this railroad south of Alton, Ill. This work is in charge of E. H. Beckler, formerly with the Great Northern Railroad, and under his direction a new line has been run from the site of the new bridge over the Mississippi River at Alton, which is now being erected, to East Alton, thence to Edwardsville and O'Fallon. This railroad is projected by the company building the new Alton railroad, and George S. Morison, of Chicago, is the President. Mr. Beckler reports that the right of way is being secured between the towns named and that the grading may possibly be commenced early in April. It is proposed to extend the line beyond O'Fallon to Belleville and other points; but the line south of O'Fallon will not be a new line. A partially graded roadbed, which was built some years ago, is now owned by the Louisville & Nashville, and the new company will probably arrange to use that roadbed.

Texas Midland.—The extension now under construction into Ennis, Ellis County, Tex., is nearing completion. This is an extension proper, and not a branch. It leaves the line as now constructed two miles nearly east from Garrett, and extends in a southwesterly dition 4⅝ miles to Ennis, but the line will be built through the city and the yards established south of it and about one mile from the station building, making altogether five miles of main line, which, with sidings, etc., will amount to six miles of track. The use of the old track from the point of divergence to Garrett will be discontinued as soon as possible on account of Garrett being an unprofitable station, and on account of heavy grades and curvature. The connection with the Houston & Texas Central, that is now made at Garrett, will be made at Ennis.

The Bethune Craney Construction Co., of Kansas City, has the contract, and has nearly four miles graded. The bridging is fairly under way, and trains will be running into Ennis within 30 days. The work is light, and will not exceed 10,000 cu. yds. of earth per mile. The most important trestle is 100 ft. long and 15 ft. high. The maximum grade is 52⅝ ft. a mile, but there is only 1,000 ft. of it. The maximum curvature is 3 degs. The station buildings at Ennis will cost $3,250. The proposed extension on the northern end of the line, from Roberts to Paris, Tex., President Green expects to have under way before summer. Martin Duvall, of Terrell, Tex., is the Chief Engineer.

West Virginia Blue Line.—This company has been incorporated in West Virginia to build a road from near Rowlesburg, in Preston County, south to Parsons, Tucker County, on the West Virginia Central & Pittsburgh, and from thence up a fork of the Cheat River to a point on the Chesapeake & Ohio. The incorporators are: C. E. Glenn, C. W. Minear, H. C. Shaffer, W. F. Lipscomb and W. B. Maxwell, of Parsons, and Wm. M. Cayton, of St. George, W. Va. The principal office of the company will be at Parsons, W. Va.

GENERAL RAILROAD NEWS.

Attica & Freedom.—This railroad, in the western part of New York State was sold at sheriff's sale in Warsaw this week for $25,000. It was bid in by a representative of the Continental Trust Company of New York.

Central of New Jersey.—The annual report of the company for the year ending Dec. 31 shows:

	1893	1892.	1891.
Gross earnings	$14,967,956	$14,713,236	$14,653,686
Oper. expenses	9,117,052	8,621,008	8,526,168
Net earnings	$5,850,904	$5,895,226	$6,127,518
Other income	1,023,535	984,529	897,276
Total incomes	$6,874,439	$6,879,755	$7,024,794
Fixed charges	4,735,649	4,549,370	4,637,349
Balance	$2,138,790	$2,330,385	$2,387,445
Dividends	1,574,112	1,572,725	1,455,430
Surplus	$564,647	$757,660	$932,015

Gross earnings increased $251,720 and were the largest in the history of the company. Operating expenses increased $296,042. The company paid for additional property charged to construction account $340,686. Additional equipment to the amount of $648,057 was bought and constructed, and after deducting depreciation, etc., the total increase in the equipment account was $355,913. Stocks and bonds of other companies increased $147,870. The funded debt was increased by $2,000,000 general mortgage bonds sold and was reduced by the $29,000 debentures converted into stock and $11,422 real estate mortgages paid off, making a net increase in the funded debt for the year $1,969,577, which represents increase in property, equipment, securities owned and reduction of floating debt. The company calculates a surplus of current assets over current liabilities of $2,807,732. Passenger earnings decreased $83,243; merchandise freight earnings decreased $162,968; anthracite coal freights increased $441,193. The number of passengers decreased 222,105; anthracite coal tonnage increased 350,697; tons of freight, including bituminous coal and not including anthracite, decreased 247,618.

Chicago, Milwaukee & St. Paul.—The following table gives the earnings and expenses of this road for the month of January and for seven months to Jan. 31:

Month of January:	1894.	1893.	Dec.
Gross earn	$2,154,822	$2,686,759	$531,937
Oper. expen	1,548,366	1,987,059	438,693
Net earn	$606,456	$699,700	$93,241
Seven months to Jan 31:			
Gross earn	$19,801,478	$22,219,825	$2,415,347
Oper. expen	12,625,368	14,345,366	1,719,998
Net earn	$7,179,110	$7,874,459	$695,349

Cleveland, Akron & Columbus.—Negotiations are reported to be pending with the receivers of the Valley Railroad, of Ohio, by which the first-named company may obtain terminal facilities in Cleveland. The Baltimore & Ohio controlls the Valley Railroad. It is proposed that the Cleveland, Akron & Columbus will have closer traffic arrangements with the Baltimore & Ohio, and will transfer business from the Pennsylvania system to the Baltimore & Ohio.

Kickapoo Valley & Northern.—Judge Bunn, in the Federal Court at Madison, Wis., on March 3, on petition of the Eastern bondholders, appointed E. A. Wadham, of Milwaukee, Receiver. The Receiver's bond is fixed at $30,000.

Leavenworth, Topeka & Southwestern.—The Receivers of the Union Pacific have notified the Receivers of the Atchison, Topeka & Santa Fe that they propose abandoning this road, owned jointly by the two companies. It is reported that the bonded indebtedness and current liabilities of the road are over $2,000,000, and that the Santa Fe is likely to take the same position as the Union Pacific, and abandon the road. The road is 46½ miles long, extending from Leavenworth to Meridin Junction, Kan.

New York, Lake Erie & Western.—The holders of the second consolidated mortgage bonds of the company, who are opposed to the scheme of reorganization proposed by the directors of the company, have appointed a protective committee to concentrate the opposition. The committee is also empowered to formulate a new plan of reorganization. The objections to the present plan are set forth in a letter to President King and J. G. McCollough, Chairman of the Reorganization Committee.

Complaint is made that it is proposed to increase the bonded indebtedness and reduce the security for the Erie seconds by more than one-half, and at the same time to reduce the interest without giving a proper equivalent. The assessment feature of the plan is also objected to, and the fact that no sacrifice is called for on the part of the stockholders.

Below is given a table showing the earnings and expenses of this road for the month of January and for the four months of the fiscal year to Jan. 31.

Month of January:	1894.	1893.	Decrease.
Gross earn	$1,748,634	$2,194,862	$446,228
Oper expen	1,442,519	1,649,102	206,583
	$306,115	$545,760	$239,645
Due to leased lines	155,894	179,443	41,549
Net earn	$150,221	$348,317	$198,096
Four months to Jan. 31:			
Gross earn	$9,054,390	$10,075,734	$1,021,344
Oper. expen	6,382,050	6,796,062	414,012
	$2,672,340	$3,279,672	$607,332
Due to leased lines	828,914	919,610	90,7.6
Net earn	$1,843,426	$2,360,032	$516 606

The stockholders of the company at a special meeting on Monday consented to the execution of the new mortgage for $70,000,000 provided for in the plan of reorganization. The vote in favor of the mortgage was 634,149 shares. The negative vote amounted to only 175 shares. On the same day Messrs. Drexel, Morgan & Co. announced that the plan had been declared operative, as a majority of each class of bonds had been deposited.

Philadelphia & Reading.—Judge Dallas, in Philadelphia, this week issued an order authorizing the Receivers of the railroad to issue $5,000,000 new coal trust bonds, the revenue from the sale of which was to be issued for the payment of the Speyer loan of $2,500,000. The loan was paid immediately, the money, it was understood, being advanced by Drexel & Co., Brown Brothers & Co. and John Lowber Welsh, this syndicate being repaid by the new issue of coal trust bonds, one-half of which were allotted to it. The payment of the loan restores to the company's treasury $1,000,000 of third preference bonds and $5,790,000 collateral trust bonds, which were held by the Speyer syndicate as collateral.

The directors of the Finance Company of Pennsylvania have approved the contract to take the entire issue of $5,000,000 coal trust bonds for the Philadelphia & Reading Coal & Iron Co., to be used by the Reading Company to carry out the plan of reorganization.

The following table gives the earnings and expenses of this road for the month of January, 1894, as compared with the same month of 1893:

Month of January:	1894.	1893.	Inc. or dec.
Gross earn	$1,394,295	$1,505,780	D. $111,485
Oper. expen	889,447	1,203,082	D. 313.635
Net earn	$504,848	$302,698	I. $202,150
Rec'ts from other sources.	88,072	57,567	I. 30,505
Profit for month	$599,920	$360,265	I. $232,655
Fixed charges (est.)	720.000	718,678	I. 1,321
Total charges	896,280	814,861	I. 81.418
Deficit	$303,360	$454,595	D. $151,236

Providence & Springfield.—The Supreme Court of Rhode Island has decided to continue the injunction to restrain the city of Providence from guaranteeing the bonds of the railroad company. These bonds, of the face value of $750,000, are now held by the New York & New England. They were issued to build the extension of the road northwest from its old terminus to connect with the New York & New England.

Richmond & Danville.—The petition of the Central Trust Co. of New York, trustees, and others for the sale of the Richmond & Danville road, under foreclosure for default in the payment of the five per cent. mortgage bonds, was argued in the United States Circuit Court at Baltimore on March 3. Judge Goff said he would sign an order compelling the masters to report the indebtedness of the road and its liabilities on or before April 1 next. The question of sale he held under advisement.

Richmond & West Point Terminal.—The reorganization committee announced this week the modifications which they have decided to make in the plan for the reorganization of the company. A pamphlet has been issued by the committee giving a full explanation of the reasons for the proposed changes, and of the theory upon which they were made. The great falling off of earnings in the past eight months is pointed out, and the fact that earnings are still at a very low level, with no immediate prospect of a return to the figures of a year ago, on which the original plan was based. It is, therefore, necessary to provide for additional indebtedness, as well as for future needs until earnings shall improve. To do this a surrender is asked of all back interest, and all coupons for a year or two come on many of the new securities going to properties which cannot make good the arrears of income already accrued. The modified plan embraces about 4,600 miles, and the securities to be issued are adjusted to this new mileage. The amounts outstanding, after reorganization, are estimated at $101,000,000 bonds, $48,000,000 preferred stock, and $120,000,000 common stock. The fixed charges are scaled down to $4,100,000 in 1894 and $4,700,000 in 1895. In 1896 and afterward they are restored to their level under the original plan. The committee believe that these figures are safe, and that substantial earnings are likely to accrue for the preferred stock. The temporary scaling down of fixed charges is done by requiring various security holders to fund coupons on the new bonds accruing to them and in most in tances to take preferred stock for the coupons funded. Among those called upon are Richmond Terminal 6s, Richmond & Danville 7s, the Northwestern North Carolina, the Oxford & Clarksville, the Clarksville & North Carolina, Charlotte, Columbia & Augusta 6s, and the East Tennessee, Virginia & Georgia general mortgage and first extension mortgage. The East Tennessee, Virginia & Georgia improvement and equipment mortgage gets bonds for the amount of its new coupons and for the interest which was to be paid it in cash, & Danville debenture 6s, which were not disturbed in the original plan, now surrender the coupons from Oct. 1, 1892, to Oct. 1, 1895, taking for each coupon $25 in bonds, the committee agreeing to make the debenture mortgage, which is now an income mortgage at six per cent., a fixed charge at five per cent. Charlotte, Columbia & Augusta 2d mortgage 7s fund three coupons into preferred stock. The assessments are changed to $10 on Richmond Terminal stock, $7.20 on East Tennessee, Virginia & Georgia common stock, but the assessment on East Tennessee, Virginia & Georgia first and second preferred stock remains unchanged. Instead of giving only preferred stock for the amount of the assessments (as was the case in the old plan), the committee says that it recognizes the inexpediency under present conditions of calling for new money on a basis adopted ten months ago, and it gives bonds for one-quarter of the new assessment and preferred stock for three-quarters. The syndicate guarantees the necessary cash ($10,550,000) over and above the assessments to carry out the plan and provide for the improvements and new construction. As the reduction in mileage has necessitated a corresponding reduction in the amount of common stock of the new company, the right of the syndicate to take the place of non-depositing stockholders is cancelled, and all the stockholders who have not already deposited their stock are ruled out absolutely. The Emergency Loan gets principal and interest in new bonds, and the floating debt will be paid off, with a few trifling concessions. The Richmond, York River & Chesapeake is reserved for negotiation. An offer of a new five per cent. bond for the firsts and about four per cent. for the seconds has been favorably considered by most of the bond and stockholders. The committee expresses itself as confidently as before regarding the ultimate value of the property. It says that all legal steps are well advanced, and that with the changes indicated above the reorganization can be carried out promptly. Of the remaining assessments on stock, under the new plan, $1.88 per share on Richmond Terminal, $1.95 on East Tennessee common, $1.50 on East Tennessee second preferred, and 75 cents on East Tennessee first preferred is called for March 20. Oxford & Clarksville, Clarksville and North Carolina, Northwestern, North Carolina and Danville, and Western bonds (which are the only ones on which a time limit has not heretofore been fixed) must be deposited by the same date. The committee makes a further advance for interest on Georgia Pacific firsts, Columbia and Greenville firsts, and Louisville Southern bonds, as was done last July. The committee announces its intention to push the reorganization vigorously to a conclusion. The Richmond Terminal is practically wound up and all its assets are owned by the committee. A decree of foreclosure for the Richmond & Danville is expected in a few days. A decree for the East Tennessee is in course of preparation. A charter, very liberal in its terms, has already been secured for the new company, and everything is now shaped for quick and successful work. Ample funds are provided for purchasing additional equipment and other improvements.

St. Louis & San Francisco.—Judge Caldwell, of the United States Circuit Court at St. Louis, has denied the application for separate Receivers for this road. The petitions of the United States Trust Co., of New York, and the Mercantile Trust Company, as holders of certain bonds, are denied, except as relates to the payment of interest by the present Receivers of the system, who must keep separate accounts of earnings and operating expenses for the various subdivisions, branches and leased lines in the combined system, the surplus of any such lines to be applied in order of priority to the payment of interest on certain mortgages as recited.

Toledo, Peoria & Western.—The Illinois Appellate Court has sustained Judge Shaw's decision by which Edward H. Durkee was ousted as one of the directors of the road, on the ground that he was elected by the bondholders rather than the stockholders. The defendants will carry the case to the Supreme Court. They hold that when the incorporators provide that the holders of bonds shall vote such bonds, and when the bonds themselves guarantee that right, they may vote them for directors. Since the suit was brought the road has practically passed into the hands of the Pennsylvania.

TRAFFIC.

Traffic Notes.

The through passenger train of the Union Pacific between Kansas City and Denver, which leaves Kansas City in the evening, has been restored, together with the corresponding eastbound train. This train was taken off last August on account of the falling off in business.

The suit of N. W. Curney, a colored man, ex-Collector of Customs and Republican politician in Galveston, Tex., against the Pullman Palace Car Company for $5,000 for refusing to sell him a berth in a car on the International & Great Northern, has been decided in the United States court against the plaintiff.

The Trunk Lines and Central Traffic Association roads have taken a further definite step toward abolishing unlimited tickets. At the meeting in New York Feb. 27 it was agreed that in the next issue of the New York Joint Tariff all unlimited rates to points beyond the western termini of the Trunk Lines, to which limited rates are regularly quoted, should be omitted.

The Louisville & Nashville put into effect on March 6 a new freight tariff which makes material reductions in many of the classes and some commodity rates. Another meeting of the Southern Railway & Steamship

Association has been called for March 18, at New York, by which time it is expected the situation will be sufficiently well defined to enable the other members to decide what action to take in view of the Louisville & Nashville withdrawal.

Judge Baker, sitting in the Federal court at Indianapolis, Ind., has granted a temporary injunction commanding the Lake Erie & Western to haul cars from the tracks of the Indiana Iron Company on that line and deliver them to the Big Four on payment of a switching charge of $2. The tracks in question are reached only over the rails of the Lake Erie & Western, which company claims by virtue of a contract with the Iron Company it is not compelled to carry freight for the latter unless it reaches Muncie over the lake Erie rails.

It is reported in Philadelphia that the trunk lines have agreed to haul wheat from New York to Buffalo during the coming summer at five cents a bushel, and to Philadelphia at 4½ cents, with correspondingly lower rates on corn. Last year the rate on wheat was maintained at six cents a bushel throughout the season of navigation, and the canal boats did a larger business than for several years before. The establishment of a joint agency in New York City seems to have been highly successful as a means of keeping rates steady and remunerative: but probably the roads found little difficulty in agreeing that the net earnings would be increased by reducing the rate a sixth.

The Second Controller of the Treasury Department at Washington has finally rendered an opinion upon the question whether the Government should pay tariff rates on freight, when demanded by railroads, which has been pending for a long time and has been the subject of argument before the second, third and fourth auditors and any number of other officers. Controller Mansur holds that, as a general rule, the schedules and classifications of freights established for individuals will be honored by the Government. When, however, a class of freights entirely exceptional in character, and of which the Government only can be a shipper, such as great cannon, armor plates, etc., shall be arbitrarily classed at some exceedingly high rate, the Controller will not feel himself obliged to honor and respect such classification.

Chicago Traffic Matters.

CHICAGO, March 6, 1894.

Reports from the East are to the effect that no substantial progress was made towards a speedy settlement of the existing demoralization both in freight and passenger rates, and another meeting is to be held next week. In the meantime a meeting is called here for March 9 to further consider the situation. Apparently little attention is being paid to published tariffs. It is stated that even the reduced grain tariff is being cut, and rates as low as 17 cents are being made. Nor is the demoralization confined to grain; it extends to nearly all commodities. While no open reductions are announced in passenger rates, rebates and commissions are alleged to be paid on all sides, and the existing associations seem powerless to stop the manipulation.

The pass agreement has been officially declared off and the other lines by resolutions flatly charge the Atchison with the entire responsibility of its failure through the refusal of that road to call in passes that had been issued to meet the alleged action of other lines. This result is what I have expected ever since the inception of the present agreement. The experiment was earnestly tried by the Western Traffic Association at a time when the association was at its prime and embraced in its membership all the trans-continental lines (including the Southern Pacific), and was a failure from the same cause which has now killed the latest effort, *i. e.*, the attempt of some line to "take care" of some of its favored shippers, trusting that its action would either not be found out or that if found out it would be found to have plenty of company. The resolutions adopted by the other Managers are not calculated to pour oil on the present troubled waters to any great extent. Among other things they say:

> This meeting takes occasion to state its conviction that the receivers of the Atchison company have not shown that regard for the interests of investors in railroad property which should be expected of officers of the court, and the responsibility of breaking up a wise and beneficient agreement lies clearly on the management of the Atchison, Topeka & Santa Fe.

Vice-President Robinson, of the Santa Fe, scores Chairman Midgley for allowing the resolutions to be passed, and sarcastically thanks the other lines for "this moral outburst." The other lines even went so far as to contemplate laying the matter before the courts, with a request for the removal of the Receivers.

The demoralization in Eastern passenger rates is spreading to Western territory through the Kansas City and Chicago gateways and was the subject of much discussion at a meeting of the Western Passenger Association yesterday.

The shipments of eastbound freight, not including live stock, from Chicago, by all the lines, for the week ending March 3 amounted to 67,940 tons, against 58,968 tons during the preceding week, an increase of 8,972 tons, and against 81,942 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	W'k to Mar. 3.		W'k to Feb. 24.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central	6,698	9.8	5,047	8.5
Wabash	6,864	10.1	4,706	8.1
Lake Shore & Michigan South.	13,084	19.3	11,436	19.4
Pitts., Ft. Wayne & Chicago	6,898	10.2	7,138	12.1
Pitts., Cin., Chicago & St. Louis	6,900	10.2	8,617	14.6
Baltimore & Ohio	5,108	7.5	2,779	4.7
Chicago & Grand Trunk	5,728	8.4	5,001	8.5
New York, Chic. & St. Louis	6,163	9.1	7,523	12.7
Chicago & Erie	8,085	11.9	4,497	7.6
C., C., C. & St. Louis	2,412	3.5	2,224	3.8
Totals	67,940	100.0	58,968	100.0

Of the above shipments 4,565 tons were flour, 34,944 tons grain and millstuff, 9,528 tons cured meats, 10,463 tons dressed beef, 1,524 tons butter, 1,317 tons hides and 3,407 tons lumber.

(*Other Chicago traffic news will be found on page* 177).

Interstate Commerce Decisions.

The Interstate Commerce Commission has announced its decision in favor of complainants in the cases of C. O. Morrell against the Union Pacific and A. S. Newland and others against the same defendants and the Northern Pacific. The cases both relate to reasonableness of rates for the transportation of wheat from points in the State of Washington to Portland, Or. The rate complained of from Pullman, Wash., to Portland was 32½ cents, but while the case was pending the road voluntarily reduced to 23¾ cents, and further reduction is not now deemed advisable. In the Newland case it is held that the rate from Ritzville to Portland should not exceed 20 cents per 100 lbs.

The Trans-Continental Passenger Rate War.

Efforts are being made to bring about a compromise between the Southern Pacific and the Santa Fe through a conference between the Presidents of the two companies. It is generally admitted that unless a speedy end is put to the existing difficulties all passenger rates west of the Mississippi River will become involved and the life of the only remaining passenger association (the Western Passenger) west of Chicago will be seriously threatened. The association has become directly involved through the demand of the Santa Fe, a member, that the association lines refuse to accept the basing rates tendered by the Southern Pacific via Ogden and Sacramento, the Santa Fe claiming its rights under an article of the agreement which provides that all association lines shall discontinue all ticketing and baggage relations with an outside line which by its actions causes demoralization in rates or loss of revenue to any member, and claiming that the Southern Pacific caused such loss by its refusal to interchange business via Los Angeles.

Chairman Caldwell on Monday rendered a decision declining to grant the request of the Santa Fe, on the ground that the Southern Pacific, in abrogating the contract after due notice, was not guilty of a breach of any specific provision of the Western Passenger Association agreement, which would entitle the Atchison to demand that other lines refuse to exchange business. The Atchison on Tuesday therefore gave formal notice of withdrawal from the association, effective March 15. This still further complicates the situation, which is considered a grave one. The Santa Fe has made a further cut in rates from Deming and El Paso to Mojave and Los Angeles of $10, making the rate either way $10. This will seriously interfere with Southern Pacific local rates.

At the meeting in Chicago last week the Santa Fe representative stated the history of the early railroad building in southern California which led up to an agreement between the two rivals which provided that the Santa Fe should pay the Southern Pacific the full local fare, $15, on through business from Los Angeles to San Francisco and a division of 18.5 per cent. of the Missouri River rate on business via Mojave; that the Southern Pacific should route its southern California business over its northern route via Sacramento with an arbitrary addition of $4 via San Francisco, in order to prevent a scalp at that point. This agreement as to Los Angeles and the $4 arbitrary had been cancelled by the Southern Pacific, consequently the Santa Fe could not compete for San Francisco business under the present terms, and the opportunity afforded the Southern Pacific to scalp at San Francisco on business from southern California put the Santa Fe at a serious disadvantage; that unless the association lines refused to accept the reduced rates via Ogden as basing rates the Santa Fe would be obliged to withdraw from the association and extend the reductions to Eastern territory.

The representative of the Southern Pacific claimed that its action was strictly in accordance with the agreement with the Santa Fe (which is conceded); that it claimed the inherent right at any time to waive the $4 Lathrop-Sacramento-San Francisco differential, which it claimed to be a local matter affecting the Southern Pacific alone (which is not conceded), and which was inserted in the rate sheet by its (S. P.) request; that, with the single exception last September, no change has yet been made in handling eastbound tickets; that it claimed the privilege of ticketing business through San Francisco as an offset to the ticketing of business through Los Angeles by the Santa Fe, and while it has refrained from exercising that right, as a matter of fact it has never waived it.

All other transcontinental rate questions are dwarfed before the present fight and have been side-tracked until such time as the outcome of the Southern Pacific-Santa Fe quarrel is determined.

Annual Report of the Pennsylvania Railroad.

The forty-seventh annual report of the Pennsylvania Railroad, for the year ending Dec. 31 last, was presented at the annual meeting of the stockholders in Philadelphia this week. Many of the most important statistics are omitted from this report and become available only on the appearance of the General Manager's report, which comes out several weeks later. We abstract the principal items presented.

Gross earnings east of Pittsburgh and Erie		$66,375,224
Expenses		46,996,017
Net earnings		$19,379,207
Rentals and interest from investments		6,036,941
		$25,416,148
Rentals paid	$9,971,696	
Interest on funded debt	4,056,165	
Car trusts, taxes, etc	1,271,851	15,299,712
Net income		$10,116,436
Sinking funds and Allegheny Valley guarantee	$641,610	
Renewals chargeable to capital	2,163,210	2,804,820
Balance		$7,311,616
Dividends, 5 per cent		6,400,508
Surplus		$911,108
Sundry receipts		1,640 673
		$2,551,782
Surplus at beginning of year		26,461,861
		$29,013,643
Deduct scrip dividend, 2 per cent		2,535,490
Final surplus		$26,478,152

The amount advanced to the Allegheny Valley was $242,975, and the sum appropriated to the sinking fund for the consolidated mortgage was $324,780. This fund now amounts to $3,386,375. Of the trust certificates issued to buy the Philadelphia, Wilmington & Baltimore there are now outstanding $7,788,000. The amount of the collateral trust loan outstanding is $9,900,000. The sum of $137,400 was paid to the trustee of the Equipment Trust Gold loan, but he could buy only $10,000 of the bonds at the stipulated price and the balance was invested in new equipment. The sinking fund for the redemption of United New Jersey obligations now amounts to $5,012,266.

Of the six millions 4-per cent. bonds authorized last year only $3,000,000 were sold. The company has bought the control of Piers 3, 4 and 5, North River, New York, issuing $2,000,000 of real estate bonds at 4 per cent. to pay for the property. These bonds run 30 years and most of them have been sold. The funded debt now amounts to $82,496,640. The increase, chiefly accounted for by the items just mentioned, is $4.978,914 The amount of capital stock outstanding is $129,271,050; the increase, $2,496,550, is due to the conversion of that amount of the scrip dividend declared last May.

The amount of securities of other corporations now owned is $118,686,409, the additions made during the past year having cost $4,037,704. The direct revenue received from these securies was $4,955,037, which is more than 4 per cent. upon their cost. The amount of car trust certificates outstanding is $8,457,000. The total number of cars provided under this system has been 57,997.

The amount expended for construction and equipment between New York and Pittsburgh was $8,332,-164, and on leased and auxiliary lines $1,332,167, a total of $9,664,331. This was for additional motive power, equipment and real estate, including the piers in New York; third and fourth track on the main line; double track on the Trenton Cut-off, and the Harrisburg, Portsmouth, Mt. Joy & Lancaster road; additions to the Broad Street station; the extension of the Philadelphia, Germantown & Chestnut Hill; the extension of the Cambria & Clearfield, and the partial construction of the Ebensburg & Black Lick, a new line projected for the development of additional bituminous territory.

The following statistics are given (cents):

	1893.	1892.
Freight receipts per ton per mile	0.611	0.626
Freight expenses per ton per mile	0.447	0.455
Net freight earnings per ton per mile	0.167	0.171
Earnings per passenger per mile	1.999	1.930
Expenses per passenger per mile	1.584	1 580
Net earnings per passenger per mile	0.415	0.400

The controlled lines east of Pittsburgh and Erie make quite as favorable a showing for 1893 as for 1892.* The amount of coal mined by the four coal companies was 2,612,788 tons, an increase of 40,372 tons.

The Pennsylvania company paid 4 per cent. on its stock and the Pittsburgh, Cincinnati, Chicago & St. Louis paid 4 per cent. on its preferred stock. The amount expended on account of construction, equipment and real estate during 1893 on the lines west of Pittsburgh was $4,523,048, largely for second, third and fourth track and for additional motive power and equipment.

The Pennsylvania system of railroads at the close of 1893, comprising about 8,800 miles, all of which are controlled either by lease or ownership, consisted of 140 corporations with an aggregate share and bond capital of about $815,000,000.

The trust of Oct. 9, 1878, which was formed to buy up guaranteed securities, now amounts to $8,847,690, on which the income for the year was 5.29 per cent. The insurance fund now amounts to $3,217,147. The amount contributed by the Pennsylvania and affiliated lines to the Employees' Relief Fund during the year was $120,353, of which over $24,000 consisted of gratuities. The amount contributed by employees was $633,-531. The average of death claims paid was $621 and the number of members in the fund 32,827. The Employees' Saving Fund now has 4,058 depositors and has $1,262,-039 on deposit.

Reference is made to the marked activity of 1892, the important extensions of second main track begun in 1893, and the serious depression of the latter part of the year. Large sums have been spent to eliminate grade crossings, especially in Philadelphia and Elizabeth, N. J., but attention is called to the fact that these great improvements will be neutralized if electric street railroads are allowed to extend their lines across the tracks of steam railroads as freely as has been attempted in the past year or two.

The Pennsylvania company sold $7,000,000 Pittsburgh, Cincinnati, Chicago & St. Louis 4½ per cent. bonds which it held; this was to pay for the improvements just mentioned and to buy stock of the Terre Haute & Indianapolis so as to secure control of the St. Louis, Vandalia & Terre Haute. This road also operates through lease or ownership the Terre Haute & Logansport and the Indiana & Lake Michigan roads, extending from Terre Haute via Logansport to St. Joseph, Mich., and the Terre Haute & Peoria, extending from Farrington, Ill., to Peoria, making in all an aggregate of 637 miles. The Pennsylvania company has bought a majority of the stock of the Toledo, Peoria & Western, 231 miles long, which connects the P., C., C. & St. L. with the Chicago, Burlington & Quincy, besides reaching the important cities of Peoria, Keokuk and Burlington. Negotiations are pending with the Burlington for joint ownership and operation.

The Toledo, Walhonding Valley & Ohio was completed in 1893, and to strengthen the position of the company as a carrier of coal to Toledo the Pennsylvania company purchased the Cleveland & Marietta, extending from New Philadelphia southward to Marietta, O., 97 miles, through the Cambridge coal field.

Reference is made to the death of Vice-President Du Barry and of Auditor George M. Taylor and to the important resignations and promotions.

South American Notes.

Mr. F. Porter Thayer has been appointed as representative in Buenos Ayres of the well known manufacturing firm of Aultman, Miller & Co., of this country.

It is reported that Sr. Juan Ponce will at once begin the construction of the branch line from the North Western Bahia Blanca Railway Co. (Argentine) to the salt lakes of the Colorado Grande.

The petition of Mr. Clark Curtin for permission to introduce crude petroleum in tank steamers into the harbors of Buenos Ayres or Riachuelo has been refused on account of the danger to shipping, but the Argentine government has signified its willingness to set aside a location sufficiently remote from ordinary shipping where storage tanks may be erected for receiving such importations.

According to the Buenos Ayres *Standard*, the guaranteed railroads in course of construction in Argentine aggregate 2,490 miles; unguaranteed railroads in course of construction, 150 miles; state railroads building, 104 miles; a total of 2,744 miles. There are projected 3,165 miles of railroad enjoying a guarantee, work on which has not been commenced, and 1,167 miles unguaranteed, also paralyzed for the present, making a total of 4,332 miles. During the year 1893 the government cancelled concessions which had been granted for 3,717 miles of road. Thus the total mileage, the building of which has not yet been abandoned, amounts to 7,076 miles. The railroads in operation to-day aggregate 8,111 miles.

* Some statistics of the lines west of Pittsburgh are given in the editorial column.—EDITOR.